Taxonomy and Phylogenetics of Nanometinae and Other Australasian Orb-Weaving Spiders (Araneae: Tetragnathidae)

Fernando Álvarez-Padilla, Robert J. Kallal, and Gustavo Hormiga

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TAXONOMY AND PHYLOGENETICS OF NANOMETINAE AND OTHER AUSTRALASIAN ORB-WEAVING SPIDERS (ARANEAE: TETRAGNATHIDAE)

FERNANDO ÁLVAREZ-PADILLA
Departamento de Biología Comparada,
Facultad de Ciencias,
Universidad Nacional Autónoma de México

ROBERT J. KALLAL
Department of Biological Sciences,
The George Washington University

GUSTAVO HORMIGA
Department of Biological Sciences,
The George Washington University

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ABSTRACT

The spider family Tetragnathidae Menge is a cosmopolitan, relatively well-studied spider clade with some members readily identifiable by their elongate chelicerae and/or their horizontal orb webs. It has four recognized subfamilies—Tetragnathinae, Metainae, Leucauginae, and the Australasian endemic Nanometinae—although many genera remain unassigned to subfamilial groups. Nanometinae alpha taxonomy is the least well understood of these lineages despite the inclusion of members of the subfamily in a number of phylogenetic analyses over the past decade. Here we describe 10 new species and revise seven additional tetragnathids from Australia, New Zealand, New Caledonia, and Papua New Guinea in the genera *Nanometa*, *Taraire*, gen. nov., *Tawhai*, gen. nov., *Harlanethis*, gen. nov., and *Iamarra*, gen. nov. These 17 species are: *Nanometa gentilis* Simon, 1908, *N. trivittata* (Keyserling, 1887), comb. nov., *N. sarasini* (Berland, 1924), comb. nov., *N. lagenifera* (Urquhart, 1888), comb. nov., *N. purpurapunctata* (Urquhart, 1889), comb. nov., *N. fea*, sp. nov., *N. tasmaniensis*, sp. nov., *N. tetracaena*, sp. nov., *N. dimitrovi*, sp. nov., *N. dutrorum*, sp. nov., *N. forsteri*, sp. nov., *Taraire rufolineata* (Urquhart, 1889), comb. nov., *Taraire oculta*, sp. nov., *Tawhai arborea* (Urquhart, 1891), comb. nov., *Harlanethis lipscombae*, sp. nov., *H. weintrauborum*, sp. nov., and *Iamarra multitheca*, sp. nov. We also synonymize *Nediphya* Marusik and Omelko, 2017, and the monotypic genus *Eryciniolia* Strand, 1912, with *Nanometa*, bringing the total number of species in the genus from one to 14. Using an expanded taxon sampling for prior studies based on six molecular markers—12S rRNA, 16S rRNA, 18S rRNA, 28S rRNA, cytochrome *c* oxidase subunit I, and histone *H3*—and both maximum likelihood and Bayesian methods, we place these taxa in the tetragnathid tree of life. Nanometinae and its constituent genera *Nanometa* and *Pinkfloydia* are reciprocally monophyletic. *Harlanethis* belongs to Leucauginae. The genera *Taraire*, *Tawhai*, and *Iamarra* defy robust phylogenetic placement and are not yet assigned to subfamily.

INTRODUCTION

The Australasian region is a hotspot of biodiversity, with much remaining to be described (Myers et al., 2000). Australia is home to thousands of spider species including dozens of members of the araneoid family Tetragnathidae Menge (World Spider Catalog, 2019). Likewise, New Zealand has only eight described tetragnathids and six in New Caledonia (World Spider Catalog, 2019). Tetragnathidae is a family of orb-weaving spiders found on all continents except Antarctica, most of which typically build horizontal orb webs with open hubs (Álvarez-Padilla and Hormiga, 2011). Currently, the family is comprised of 48 genera and over 1000 species, with almost 50 of those described in the past five years (World Spider Catalog, 2019). Phylogenetic studies with broad taxon sampling indicate the closest relatives of the family are Arkyidae and Mimetidae—two araneoid families that do not spin capture webs; arkyids are "sit and wait" predators while mimetids use aggressive mimicry to prey primarily on other araneoids (Hormiga and Griswold, 2014). Arkyids and mimetids together with Tetragnathidae form the strongly supported tetragnathoid clade (Dimitrov and Hormiga, 2011; Dimitrov et al., 2012, 2017; Benavides et al., 2017; Hormiga, 2017; Wheeler et al., 2017; Fernández et al., 2018; Kallal and Hormiga, 2018).

Tetragnathidae includes four widely acknowledged subfamilies—Tetragnathinae, Leucauginae, Metainae, and Nanometinae—in addition to a host of rogue and difficult to place lineages. The latest of these to be formally acknowledged is Nanometinae, first as a clade (Álvarez-Padilla 2007) based on morphological and behavioral data, then as the "*Nanometa* Clade" (Álvarez-Padilla et al., 2009) based on morphological, behavioral, and nucleotide sequence data. Forster and Forster (1999) had informally proposed the family Nanometidae for this group, but they did not provide a proper diagnosis. Álvarez-

Padilla and Hormiga (2011: 802) formalized this taxon group at the subfamilial rank. Additional data supporting the *Nanometa* Clade were introduced in when the genus *Pinkfloydia* Hormiga and Dimitrov was placed as sister taxon to all other members of that clade (Dimitrov and Hormiga 2011). Subsequent analyses all supported the monophyly of the subfamily Nanometinae, with more and more taxa falling into this clade without formal taxonomic treatment (Dimitrov et al., 2012, 2017; Wheeler et al., 2017, Kallal and Hormiga, 2018), and a number of new genera and species have also recently been described in the subfamily (Hormiga, 2017; Marusik and Omelko, 2017). Most recently, phylogenomic analyses have placed nanometines as either sister to Tetragnathinae or Metainae + Leucauginae with mixed support (Fernández et al., 2018), with the caveat that each subfamily was represented by a single taxon.

Morphologically, nanometines are most similar in appearance to metaines (as their name implies) in that they lack the femoral trichobothria found in tetragnathines and leucaugines and the elongate chelicerae of tetragnathines. Álvarez-Padilla et al. (2009) characterized the synapomorphies of nanometines, which were further revised by Dimitrov and Hormiga (2011) and Hormiga (2017) to include the conductor originating centrally on the tegulum, a solid conductor-tegulum attachment, tubular embolus, and absence of macrosetae on the male palpal patella. *Pinkfloydia* lacks the stridulatory ridge on the male booklung cuticle and the branched median tracheal trunks found in *Nanometa* Simon, 1908 (Dimitrov and Hormiga, 2011).

Nanometines are known exclusively from the Australasian region, here including Australia, New Zealand, New Caledonia, and Papua New Guinea. Despite collection work over decades in these areas, the number of undiscovered and undescribed taxa has made the taxonomy of lineages in these places a difficult problem. Raymond Forster (1922–2000) had dozens more putative nanometine morphospecies for description, suggesting the treatment of nanometine spiders in that region includes a vast number of taxa that remain to be described and understood. Beyond the nanometines, the Australasian region is very diverse in other tetragnathids as well. The descriptions of some of these species are limited in scope and detail by modern standards, and incorporation of DNA sequence data has pointed to the nonmonophyly of some genera, including the metaine *Meta* C.L. Koch and the leucaugine *Orsinome* Thorell, 1890.

This revision seeks to highlight the members of the subfamily Nanometinae and formally describe a number of nanometine and other Australasian tetragnathids. Foremost among these is *Nanometa* (figs. 1–3, 7–37). Four new genera outside Nanometinae are erected: *Harlanethis*, gen. nov. (figs. 38–44, 60), *Taraire*, gen. nov. (figs. 4–5, 45–50, 55), *Tawhai*, gen. nov. (figs. 5, 51–55), and *Iamarra*, gen. nov. (figs. 6, 56–60). Among these are descriptions and redescriptions of 17 species, 11 of which belong to the genus *Nanometa*. Using an expanded nucleotide sequence matrix including 85 taxa, we discuss an updated Nanometinae and provide a framework for further studies of Australasian tetragnathids.

MATERIAL AND METHODS

Specimens were examined using a Leica MZ16A or a Leica M205 stereomicroscope (Wetzlar, Germany). Photographs were taken with Leica DFC500 and DFC425 digital microscope cameras. Habitus and genitalic morphology pictures were taken by placing the specimens in white sand immersed in 95% ethanol. Multifocus images were taken at different focal lengths with the package Leica Application Suite (LAS) v. 3.8 and stacked using Helicon Focus (ver. 6.7.1; www.heliconsoft.com) from Helicon Soft Ltd (Kharkiv, Ukraine). Most hairs and macrosetae are usually not depicted in the final palp and epigynum drawings. Illustrations were completed using an Olympus BX51 microscope with camera lucida (Tokyo, Japan) or Leica stereoscope as above. Epigyna were transferred to methyl salicylate for examination of sclerotized structures (Holm, 1979). Scan-

TABLE 1

Taxon sampling and associated NCBI GenBank accession numbers

Values in bold are new for this study.

Taxon	12S	16S	18S	28S	COI	H3
Allende nigrohumeralis		EU003271	EU003368 EU003370	EU003396		
Allende sp. GH889			GU129574		GU129635	GU129649
Antillognatha lucida			GU129576 GU129577	GU129603	GU129631	GU129647
Arkys sp. GH1250	KM486216	KM486277	KM486129	KM486344		
Arkys sp. GH1107	KM486220	KM486281		KM486348	KM486423	KM486475
Arkys sp. GH1252	KM486221	KM486282	KM486132	KM486349	KM486424	KM486477
Arkys sp. GH1586	KM486217	KM486278	KM486130	KM486345		
Arkys cornutus		FJ607448	FJ607482	FJ607521	FJ607556	FJ607595
Australomimetus sp. GH1115	KP271530		KP271653	KP271728	KP271798	KP271855
Azilia guatemalensis	EU003232	EU03262	EU003371 EU003372 EU003373	EU003399	EU003280	EU003313
Azilia sp. GH0834		GU129570	GU129581	GU129606	GU129624	GU129641
Azilia sp. GH0838			GU129582	GU129607	GU129625	GU129642
Chrysometa alboguttata	MF668699	MF663665	EU003389	EU153160 EU003400		EU003314
Chrysometa poas	MF668700	MF663663	MF668716	MF668708	MF674516	MF681788
Chrysometa zelotypa	MF668701	MF663664	MF668717	MF668709	MF6745167	MF681789
Chrysometa espanola			EU003344	EU153162 EU003402	EU003283	
Cyrtognatha sp. GH0773				GU129609	GU129630	GU129645
Cyrtognatha sp. GH0774				GU129610	GU129629	GU129646
Cyrtognatha sp. ATOL GH12	KY015599	KY016146	KY016735	KY017394	KY017951	KY018453
Diphya spinifera			GU129584 GU129585	GU129611	GU129626	GU129643
Dolichognatha incanescens	MF668702	MF663667		MF668710	MF674518	MF681790
Dolichognatha longiceps	MF668703	MF663666	MF668719	MF668711		MF681791
Dolichognatha pentagona	MF668704	MF663669	MF668720	MF668712	MF674519	MF681792
Ero sp. GH1092	KP271604	KP271663	KP271663	KP271738	KP271804	
Gelanor sp. GH1605	KP271552		KP271678	KP271750	KP271817	KP271881
Nanometa trivittata, comb. nov. GH1152		KM486314	KM486170	KM486382		KM486501
Glenognatha mendezi			GU129586	GU129612	GU129627	

TABLE 1 *continued*

Taxon	12S	16S	18S	28S	COI	H3
***Harlanethis lipscombae*, sp. nov. GH1144**			**MK841587**		**MK840828**	
Hispanognatha guttata			GU129587 GU129588	GU129613	GU129633	GU129652
Iamarra multitheca, sp. nov. ATOL GH59	KY015600	KY016147	KY016736	KY017395	KY017952	
Iamarra multitheca, sp. nov. GH1142	KM486271	KM486334	KM486202	KM486412		KM486524
Leucauge argyra		EU003264	EU003364	EU003427	EU003290	EU003339
Leucauge blanda		JN816495	JN816717	JN816926	JN817129	
Leucauge magnifica	AY164672	HQ441966	JN816718	JN816927	HQ441946	
Leucauge venusta	EU003238	FJ525356	EU003350	EU153169 EU003409	EU003291	EU003322
Leucauge sp. ATOL GH9			KY016738	KY017397	KY017953	KY018455
Mecynometa sp. GH0850			JN816718	GU129614		GU129639
Mesida sp. GH0535			GU129589 GU129590	GH129615		GU129650
Mesida sp. ORB016			KR526440	KR526482	KR526575	KR526615
Meta manchurica		JN816499	JN816721	JN816930	JN817133	
Meta menardi		KC849121	EU003353	EU153173 EU003413	EU003295	EU003325
Meta ovalis		FJ607460	FJ607497		FJ607571	FJ607609
Meta sp. ATOL GH47			KY016148	KY016739	KY017398	KY017954
Metabus ebanoverde		EU003265	EU003354	EU153174 EU003414	EJ003296	EU003326
Metellina mengei	MF668706	MF663668	MF668722	MF668714	MF674520	
Metellina merianae		EU003270	EU003356	EU153176 EU003416	EU003297	EU003328
Metellina ornata		JN816498	JN816720	JN816929	JN817132	
Metellina segmentata		FJ607461	FJ607498	FJ607536	FJ607572	FJ607610
Metleucauge banksi			GU129599	GU129621	GU129636	
Metleucauge yunohamensis		JN816500	JN816722	JN816931	JN817134	
Mimetus sp. GH891		KP271633	KP271702	KP271774	KP271838	
Mimetus sp.		FJ607463	FJ607500	FJ607538	FJ607574	
Mollemeta edwardsi			GU129575	GH129623	GU129634	EU003330
Nanometa forsteri, sp. nov. GH1137	KM486245	KM486317	KM486175	KM486387	KM486458	

TABLE 1 *continued*

Taxon	12S	16S	18S	28S	COI	H3
Nanometa forsteri, sp. nov. GH1139	KM486246	KM486318	KM486176	KM486388	KM486459	
Nanometa dutrorum, sp. nov. GH0128			GU129595 GU129596 GU129597	GU129619 GU129620	GU129639	
Nanometa gentilis GH0114	KM486247	KM486319	KM486177	KM486389	KM486460	KM486505
Nanometa lagenifera, comb. nov. GH1172		KM486315	KM486171	KM486383		
Nanometa purpurapunctata, comb. nov. FAPDNA066			EU003391	EU153179 EU003420		EU003331
Nanometa purapurapunctata, comb. nov.		KM486295	KM486146	KM486362		
Nanometa sarasini, comb. nov. FAPDNA067		EU003272	EU003357	EU153177 EU003417	EU003299	
Nanometa tasmaniensis, sp. nov. GH0124			GU129592 GU129593 GU129594	GU129617 GU129618		
Opadometa sp. FAPDNA047		EU003266	EU003361	EU003423	EU003304	EU003336
Opadometa TL-2013	KC848936	KC849142	KC848955	KC849016	KC849101	KC849057
Orisnome lorentzi		EU003267	EU003362	EU153181 EU003424	EU003305	EU003337
Orsinome megaloverpa			KM486203	KM486413		
Pachygnatha degeeri		EU003261	EU003363	EU153182 EU003425	EU003306	EU003338
Pachygnatha ATOL GH31	KY015602	KY016150	KY016741	KY0167400	KY017956	KY018457
Pachygnatha ATOL GH34			KY016742	KY017401	KY017957	KY018458
Pararchaea alba	KM486254	KM486324	KM486184		KM486463	KM486511
Pinkfloydia harveii			GU129571 GU129572 GU129573	GU129601 GU129602	GU129628	GU129640
Pinkfloydia rixi		KM486328	KM486190	KM486401	MF281417	KM486515
***Taraire oculta*, sp. nov. GH1133**	**MK841590**	**MK841586**	**MK841588**	**MK841584**		**MK840830**
Taraire rufolineata, comb. nov.	KM486244	KM486316	KM486173	KM486385	KM486456	KM486503
***Tawhai arborea*, comb. nov. GH1117**		**MK841585**		**MK841583**		**MK840829**
Tawhai arborea, comb. nov. ATOL CG103	KY015597	KY016143	KY016734	KY017393	KY017950	KY018452
Tetragnatha acuta	AY803925	AY803916			AY803906.1	
Tetragnatha mandibulata		AY230938	AY230895	AY231069	AY231027	

TABLE 1 *continued*

Taxon	12S	16S	18S	28S	COI	H3
Tetragnatha versicolor	EU003446		EU003394	EU153185 EU003429	EU003308	
Tetragnatha sp. ATOL GH19		KY016151	KY016743		KY017958	KY018459
Tylorida striata			EU003365	EU153186 EU003430	EU003309	
Tylorida striata			KY016745	KY017403		KY018461
Tylorida ventralis	KM486268		KM486207	KM486417	KM486470	KM486526
Tylorida ventralis			KU836923		KU836889	
Zhinu manmiaoyangi	MF668707	MF663662	MF668723	MF668715	MF674521	MF681794

ning electron microscopy (SEM) images were captured using the LEO 1430VP at the Department of Biological Sciences of the George Washington University (GWU). Specimens were critical point dried, sputter-coated in a gold-palladium alloy, and mounted as described in Álvarez-Padilla and Hormiga (2007). Male palp sclerite homologies and nomenclature follow Álvarez-Padilla and Hormiga (2011). All measurements are in millimeters.

Taxon sampling for this work includes 85 taxa from a number of previous works (Arnedo et al., 2004; Blackledge and Gillespie; 2004; Álvarez-Padilla et al., 2009; Blackledge et al., 2009; Dimitrov and Hormiga, 2011; Gregorič et al., 2015; Dimitrov et al.; 2017; Hormiga, 2017; Wheeler et al., 2017; Kallal and Hormiga, 2018), with novel sequences for the following taxa: *Tawhai arborea* (Urquhart, 1891), (GH1117), *Taraire oculta* (GH1133), and *Harlanethis lipscombae* (GH1144). These are summarized in Table 1. The majority of nanometine taxa with sequence data examined have been included in previous analyses, but are treated here for the first time taxonomically. For clarity, these are: *Meta rufolineata* GH 1136 = *Taraire rufolineata*; *Meta* sp. 01 GH1133 = *T. oculta*; *Allende* CG103 = *Tawhai arborea*; Metainae sp. GH0123 = *Nanometa tasmaniensis*; Metainae sp. GH0124 = *N. tasmaniensis*; Metainae sp. GH0128 = *N. dutrorum*; *Nanometa* sp. FAPDNA066 = *N. purpurapunctata*; *Nanometa* sp. FAPDNA067 = *N. trivittata*; *Nanometa* sp. GH1152 = *N. trivittata*; *Nanometa* sp. GH1137 = *N. forsteri*; *Nanometa* sp. GH1139 = *N. forsteri*; *Nanometa* sp. GH1172 = *N. lagenifera*; *Dolichognatha* GH59 = *Iamarra multitheca*; and *Orsinome* cf. *vethi* FAPDNA052 = *O. lorentzi* Kulczyński, 1911.

Six genetic markers were amplified from leg tissue using the Qiagen DNEasy kit. These markers were the mitochondrial ribosomal markers 12S rRNA (~400 bp) and 16S rRNA (~550 bp), nuclear ribosomal markers 18S rRNA (~1800 bp) and 28S rRNA (~2700 bp), nuclear protein-coding gene histone *H3* (~327 bp) and mitochondrial protein-coding gene cytochrome *c* oxidase subunit I (COI; 771 bp). PCR was completed using the Promega GoTaq kit Amplified products were sent to Macrogen in Rockville, MD, for sequencing. Contigs were formed using Geneious 6.0.6, and then submitted to the NCBI BLAST database to check for contamination. Multiple sequence alignments were completed using MAFFT v. 7 (Katoh and Standley, 2013). Alignments of 12S and 16S were completed using L-INS-i, which is ideal for samples with a single conserved domain. For the more problematic 18S and 28S, the E-INS-i method was used. The protein-coding genes COI and *H3* were aligned using MACSE

v.2 (Ranwez et al., 2018), which can detect frameshifts and stop codons in alignments accounting for the translation codes. To account for missing data and poor alignment, trimAl v.1.2 was used with the gappyout setting (Capella-Gutiérrez et al., 2009).

The sequence data were divided a priori by marker, and for the protein-coding markers, further divided by codon position, resulting in 10 possible partitions. These were used as the partitions for RAxML v. 8 (Stamatakis, 2014), and were further tested using PartitionFinder 2 (Lanfear et al., 2017) for MrBayes (Ronquist and Huelsenbeck, 2003) using CIPRES (Miller et al., 2010). For partitioning for analysis using IQ-TREE (Nguyen et al., 2015), the best scheme was tested for using ModelFinder (Kalyaanamoorthy et al., 2017), a partitioning module integrated into IQ-TREE.

Maximum likelihood analysis in RAxML was conducted on CIPRES (Miller et al., 2010) using the GTRGAMMA model, with results evaluated using 1000 bootstrap pseudoreplicates. IQ-TREE results were evaluated with bootstrap support using UFBoot2 (Hoang et al., 2018). Relaxed-clock Bayesian analyses were conducted using the high-performance cluster Colonial One at GWU. We used the fossilised birth-death prior for undersampled lineages and the independent gamma rates model with broad speciation priors (exp[10]), extinction (b[1,1]) and fossilization (b[1,1]) following Zhang et al. (2016) and Pyron (2017). The tree age prior was set to 118–170 million years ago (Ma) based on analyses by Fernández et al. (2018). The clock rate prior is set by log-normalizing the estimated substitution rate of COI (Bidegaray-Batista and Arnedo, 2011). In total, 16 chains (four cold, 12 heated) were run for 100 million generations with the first 10% discarded as burn-in. Convergence was considered achieved when the standard deviation of split frequencies were below 0.01, estimated sample sizes (ESS) were above 200, and traces from log files examined in Tracer v.1.6 (Rambaut et al., 2014) had reached stationarity as indicated by a plateau of likelihood values. All trees were rooted using the taxon *Pararchaea alba* Forster, 1955, based on recent prior studies showing Malkaridae Davies, 1980, is a close relative of the tetragnathoids (Dimitrov et al., 2017; Wheeler et al., 2017; Fernández et al., 2018; Kallal et al., 2018).

Anatomical abbreviations: AC, aciniform gland spigot; AME, anterior median eyes; BEA, basal embolic apophysis; C, conductor; CDBP, cymbium dorso-basal process; CEBP, cymbial ecto-basal process; CD, copulatory duct; CEMP, cymbial ecto-median process; CO, copulatory opening; CY, cylindrical gland spigot; Cy, cymbium; E, embolus; FD, fertilization duct; FL, flagelliform gland spigot; MAP, major ampullate gland spigot; mAP, minor ampullate gland spigot; P, paracymbium; PI, piriform gland spigot; PLE, posterior lateral eye; S, spermatheca; ST, subtegulum; T, tegulum.

Institutional abbreviations: AM, Australian Museum, Sydney, New South Wales, Australia; AMNH, American Museum of Natural History, New York; CMNZ, Canterbury Museum, Christchurch, New Zealand; GWU, the George Washington University, Washington, DC; MNHN, Muséum National d'Histoire Naturelle, Paris, France; MONZ, Museum of New Zealand Te Papa Tongarewa, New Zealand; NMV, National Museum of Victoria, Melbourne, Victoria, Australia; QM, Queensland Museum, Brisbane, Queensland, Australia; QVMAG, Queen Victoria Museum, Launceston, Tasmania, Australia; WAM, Western Australian Museum, Perth, Western Australia, Australia.

RESULTS

Taxonomy

Family Tetragnathidae Menge, 1866

Subfamily Nanometinae Forster and Forster, 1999

Nanometidae Forster and Forster, 1999: 166.
Nanometinae Álvarez-Padilla and Hormiga, 2011: 802.

Type genus: *Nanometa* Simon, 1908.

Diagnosis: Male nanometines are diagnosed from other tetragnathids by their cymbial ecto-basal process shaped as relatively large spine

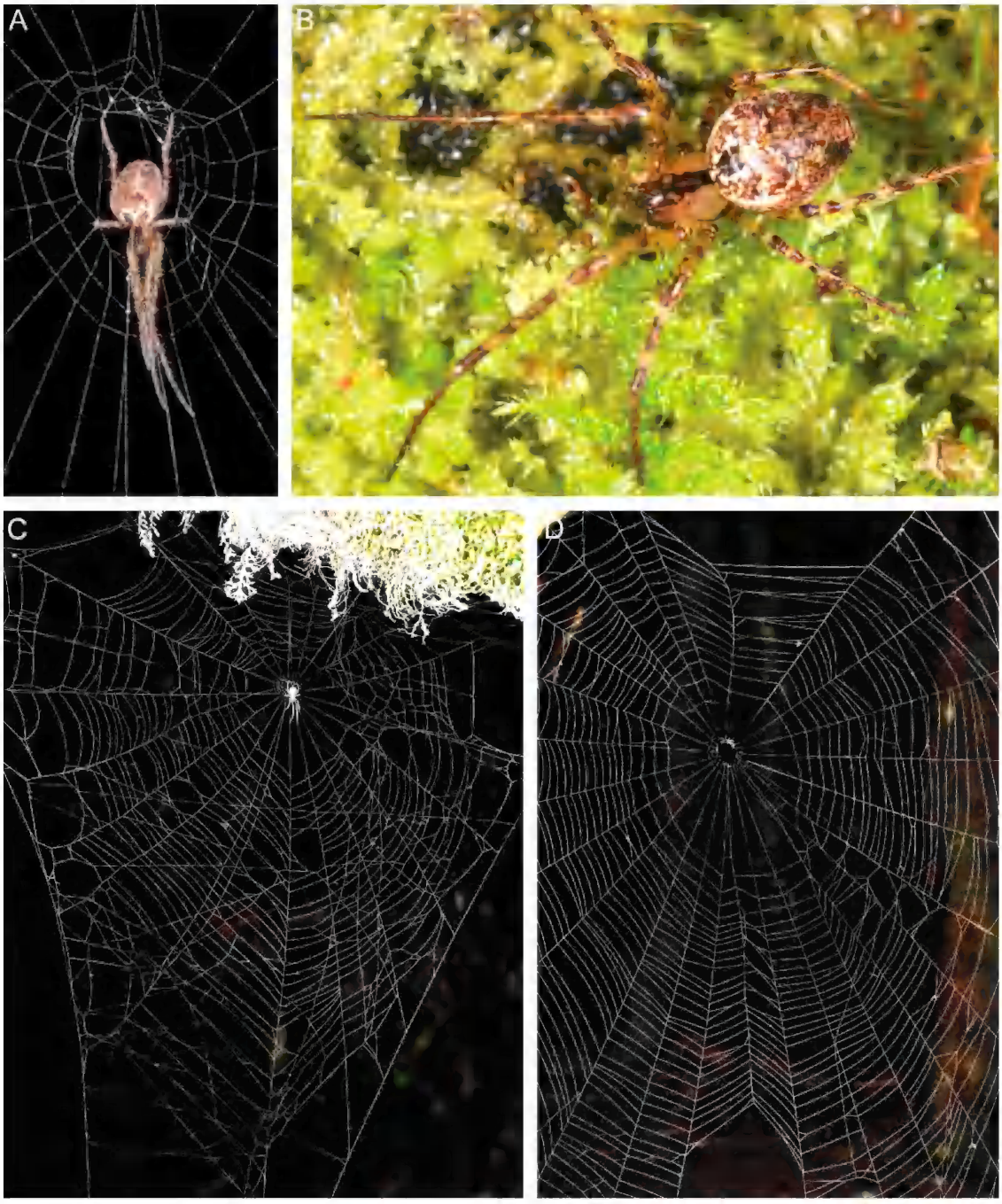

FIGURE 1. *Nanometa tasmaniensis* from Tasmania (Australia). **A.** Adult female in web with the typical resting posture (DSC_0244). **B.** Adult female (DSC_1599). **C.** Web of adult female (DSC_0304). **D.** Web of adult female (DSC_0249). A, C, D: Cradle Mountain National Park; B: near Marakoopa Cave (photos: G.H.).

FIGURE 2. *Nanometa tasmaniensis* from Tasmania (Australia). **A.** Adult male (DSC_1788). **B.** Juvenile web (DSC_1598). **C.** Unfinished adult female web (two turns of the nonsticky temporary spiral remain in the web; DSC_1645). A: Lake St. Clair National Park; B, C: Mount Field National Park (photos: G.H.).

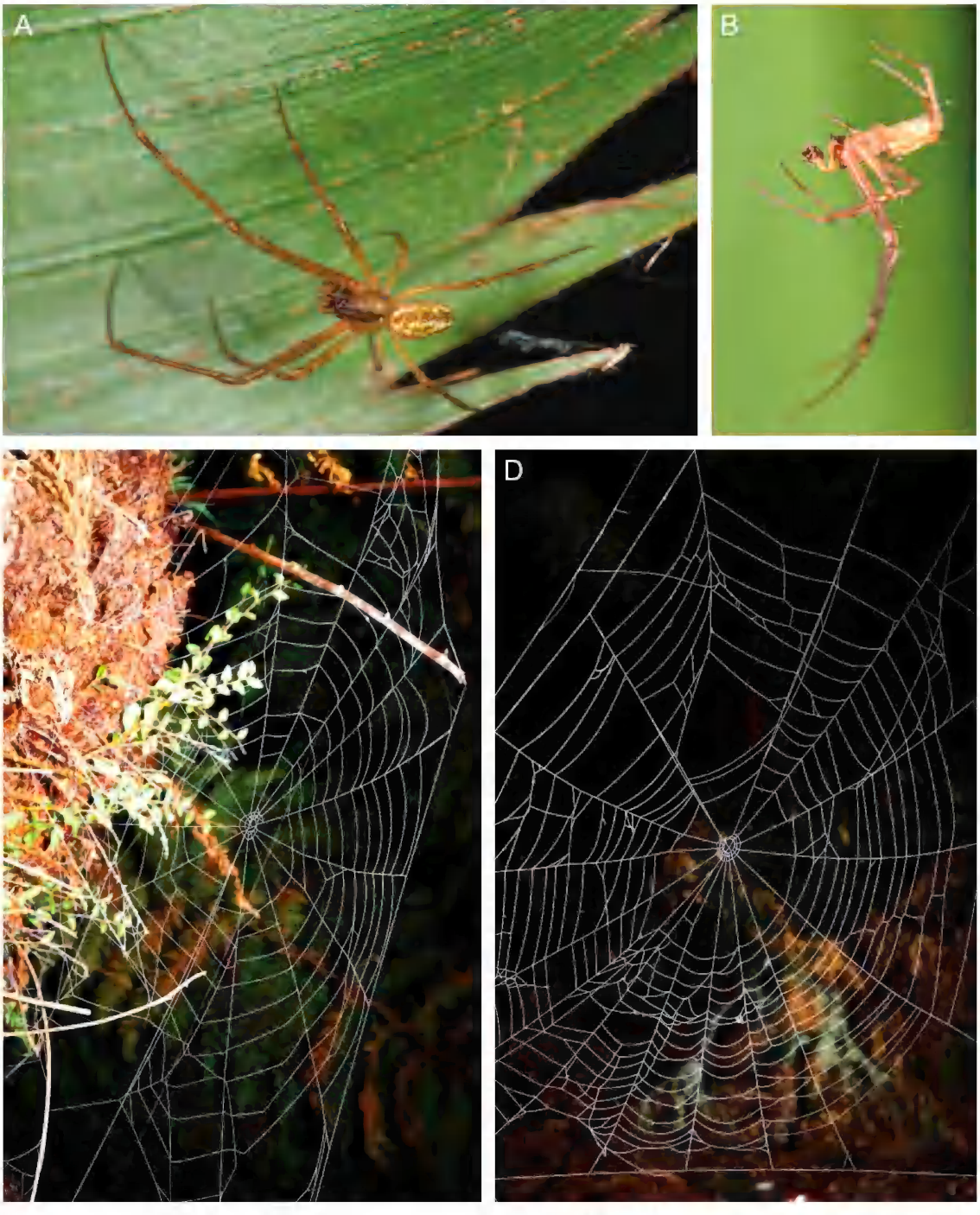

FIGURE 3. *Nanometa trivittata* (Keyserling, 1887) from Australia. **A, B.** Adult male from Border Ranges National Park, New South Wales (DSC_1840, DSC_1868). **C, D.** Female web from Great Otway National Park (DSC_1454, DSC_1446; photos: G.H.).

FIGURE 4. *Taraire* from New Zealand **A.** *T. rufolineata* (Urquhart, 1889) female web (DSC_7979). **B.** *T. oculta* female web (DSC_7919). **C.** *T. oculta*, adult male (G43A109). A: Arthur's Pass National Park, South Island; B, C: Fox Glacier, Westland Tai Poutini National Park, South Island (photos: G.H. except 4C, Gonzalo Giribet).

FIGURE 5. *Taraire ocula* (A, B), and *Tawhai arborea* (Urquhart, 1891) (C), from New Zealand. **A.** Juvenile web (DSC_7977). **B.** Juvenile web (DSC_7964). **C.** Female web (DSC_6287). A, B: Fox Glacier, Westland Tai Poutini National Park, South Island; C: Tongariro National Park, North Island (photos: G.H.).

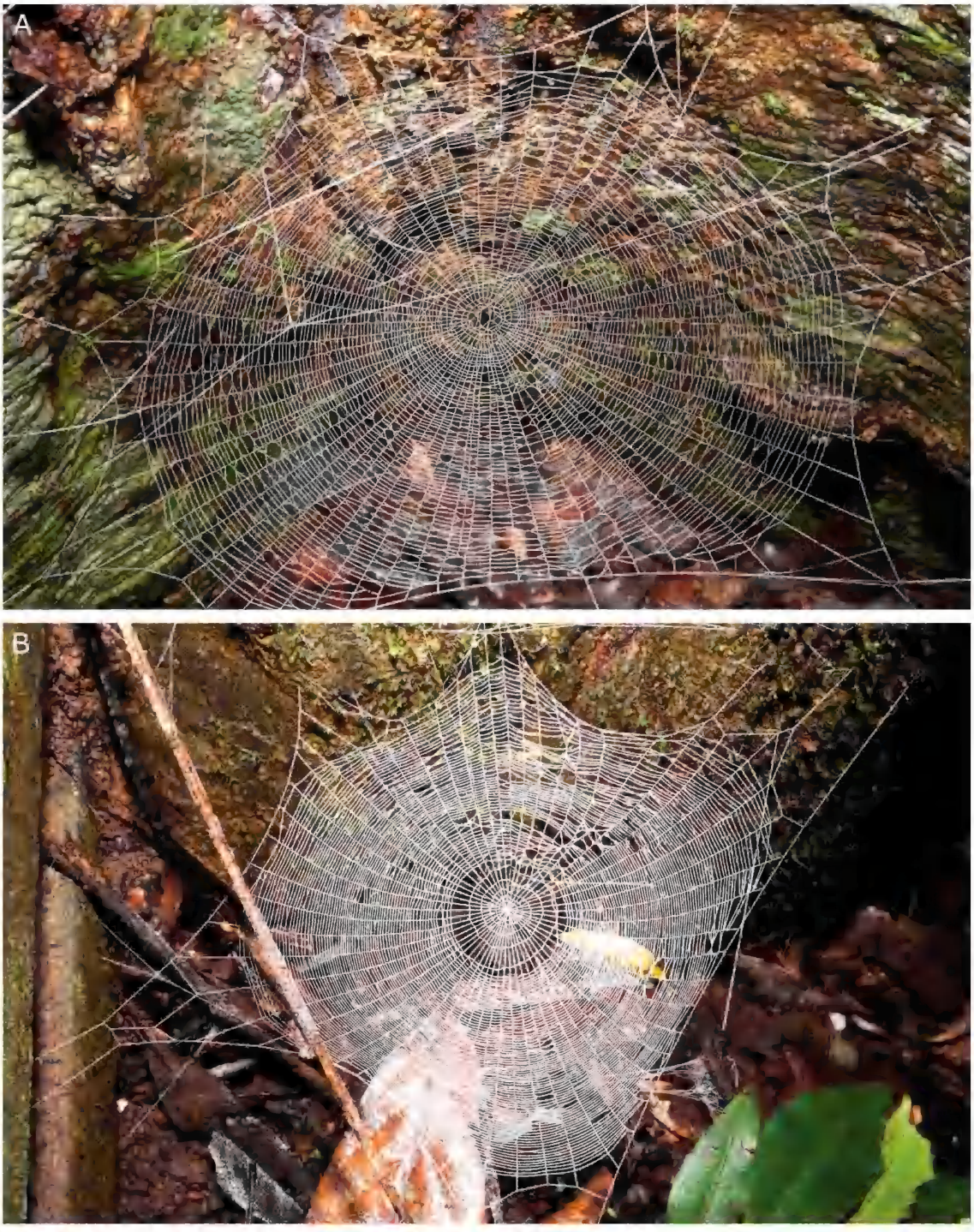

FIGURE 6. *Iamarra multitheca*, adult female webs at the base of trees from Crater Lakes National Park, Queensland, Australia. **A.** Finished web (DSC_8086). **B.** Unfinished web (several turns of the nonsticky temporary spiral remain in the web; DSC _8070; photos: G.H.).

attached to the cymbium (e.g., figs. 7B, 8C, 10E, 23E). This process is smaller in *Taraire* (figs. 46D, 48E, F, 49C, 50C) and *Chrysometa* (Salgueiro-Sepúlveda and Álvarez-Padilla, 2018: 308, fig. 4A–C), long and flattened in *Tawhai* (figs. 52D, 54A–C), and bearing small teeth in *Allende* Álvarez-Padilla, 2007 (Álvarez-Padilla, 2007: 295, fig. 5C). The conductor originates from the center of the tegulum; it is shaped either as a flat disk in *Nanometa* (figs. 10C, F, 13C) or projects apically in *Pinkfloydia* (Dimitrov and Hormiga, 2011: 759, fig. 14A). Although the branched median tracheae (figs. 11D, 30D) and the booklung-coxae stridulatory apparatus (figs. 20F, 30C) are found in most nanometines, these two features are absent in *Pinkfloydia*. Female nanometines present two types of genital anatomy. One is found in *Pinkfloydia*, with a protruding epigynal plate (relative to *Nanometa*) bearing numerous pores opening on its ventral surface (Dimitrov and Hormiga, 2011: 761, fig. 15G) (similar to those of *Tawhai*), soft-walled spermathecae, and copulatory and fertilization ducts short, parallel, and well sclerotized (Dimitrov and Hormiga, 2011: 761, figs. 15F–H). The other is a flat epigynal plate, without conspicuous pores and four receptacles, two of which are the spermathecae shared by all *Nanometa* as well as *Taraire* (figs. 9H, 11C, 13E, 47F, 48C, 50E).

Relationships: Putative morphological synapomorphies of Nanometinae include the conductor originating from the center of the tegulum, a flexible conductor-tegulum attachment, tubular embolus, a basal ecto-basal process shaped as relatively large spine; absence of macrosetae on the male palpal patella; presence of cheliceral denticles, and epigynal mating plug from secretions (Álvarez-Padilla and Hormiga, 2011; Dimitrov and Hormiga, 2011).

Composition: Two genera, *Nanometa* and *Pinkfloydia*. In favor of taxonomic stability, *Taraire*, *Tawhai*, *Chrysometa*, *Allende* and *Metleucauge* remain outside Nanometinae, because the nodes involving their placement lack strong consistent support (figs. 61–63).

Distribution: Nanometines are distributed in New Zealand, Australia, New Caledonia, and Papua New Guinea.

Genus *Nanometa* Simon, 1908

Nanometa Simon, 1908: 11. Type species: *Nanometa gentilis* Simon, 1908, by monotypy.

Eryciniolia Strand, 1912: 346. Type species: *Linyphia purpura-punctata* Urquhart, 1889. New synonymy.

Nediphya Marusik and Omelko, 2017. Type species: *Nediphya lehtineni* Marusik and Omelko, 2017. New synonymy.

Diagnosis: The internal epigynal structures of *Nanometa* are similar to those found in *Taraire* from New Zealand. The copulatory ducts of *Nanometa* are modified as membranous sacs and separated from the spermathecae, giving the appearance of four receptacles (figs. 9H, 11C, 13E). The accessory glands found in *Nanometa* and *Taraire* were used to homologize the spermathecae; however, these accessory glands were not discussed in the description of *Nediphya* (Marusik and Omelko, 2017). *Nanometa* species can have the eyes in two (fig. 9G, I) or three rows (Marusik and Omelko, 2017: 1–4, 6–8). The AME are slightly reduced in *N. purpurapunctata* (fig. 26G, I), but that arrangement differs considerably from *Nanometa lehtineni* in dorsal view, in which the PLE are enlarged (Marusik and Omelko, 2017: figs. 1–4). The posterior edge of the epigynum in *Nanometa* never extends below the epigastric furrow (fig. 10A, B), in contrast to *Taraire*, where the posterior edge extends beyond the epigastric furrow (fig. 47A, B). *Nanometa* cymbial processes can be easily homologized with those of *Pinkfloydia*, *Taraire*, and *Tawhai*, in addition to many tetragnathids, such as *Chrysometa* Simon, 1894, *Meta* C. L. Koch, 1836, *Metellina* Chamberlin and Ivie, 1941, and *Allende*. The CEBP of *Nanometa* is basal to the paracymbium and usually bears one to several spines (figs. 7B, 8A, 10F, 23E, F), the CEMP is a cuticular fold distal to the CEBP either covered with normal

setae (figs. 7D, 10E), armed with modified structures as in *Pinkfloydia* (Dimitrov and Hormiga, 2011: figs. 8A, 13H) or as a tiny cuticular fold in *Nanometa lehtineni* (Marusik and Omelko, 2017: figs. 38, 39). *Nanometa* males can be separated from those of *Taraire*, *Tawhai*, and *Iamarra* by the absence of basal embolic apophyses (figs. 49A–C, 54A–C, 59C, D) and by the conductor formed by a flat coiled sclerite with sclerotized margins and translucent middle section (fig. 10C); this structure is folded in the latter two genera (figs. 46A, B, 49A, 50B). *Nanometa* males can be further separated from other tetragnathids by the presence of a stridulatory organ on the booklung cuticle that probably interacts with several cusps on the retrolateral surface of coxa IV (figs. 20F, 26F, 30C). The small size is no longer a useful diagnostic feature for *Nanometa* with the addition of some of these new species (2.7–9.5 mm).

Description: Female total length 2.3–8.8. Cephalothorax length 0.9–3.6, width 0.7–2.7. Carapace glabrous, background pale yellow to brown, cephalic region dark gray or brown, darker coloration tapering toward fovea, carapace margins outlined by the same pattern covering the cephalic region (figs. 9A, 18A, 36A). Fovea deep, triangular in shape or as a transverse line, carapace dorsal pits absent. Clypeus height 0.9–2.7 AME diameter, cuticle darker below median eyes and paler below lateral eyes (figs. 9G, 36I, J). AME slightly larger than PME; except in *N. purpurapunctata*, which has reduced AME. Lateral eyes juxtaposed on a tubercle (separated in *N. purpurapunctata*), one AME diameter apart from median eyes and approximately half that size. Chelicerae with few scattered setae, cuticle smooth, without ventral stridulatory ridges. Promargin with three teeth, retromargin with none to two, cheliceral denticles present. Endites longer than wide, dark brown, internal margins lighter in coloration. Labium rectangular, wider than long, colored as endites. Sternum yellowish to dark brown, trapezoidal in shape, wider between first two legs (figs. 9E, 18C, 21E). Abdomen dorsum covered with silvery guanine patches, background either brown or gray. Silvery guanine patches in small species cover the entire abdominal dorsum giving a shiny appearance; larger species' patches are isolated in spots giving a less shiny appearance when alive (figs. 9A, 14A, 36A). Venter with a central dark longitudinal rectangle flanked by two parallel lines of guanine patches (figs. 9E, 18C, 20E) (pattern less conspicuous in *Nanometa tasmaniensis*: fig. 21E). Lateral surfaces with either a complete longitudinal area of guanine patches, or this area interrupted with a reticulated pattern either dark gray or dark brown (figs. 9C, 26C, 36E). Booklung covers without stridulatory organs, except in *N. sarasini* (fig. 14H). Spinnerets pale gray to brown, lighter pattern on internal surfaces. Leg formula 1-2-4-3; femur I length 1.1–6.9; first pair considerably larger, all leg segments from pale yellow to dark brown, decorated with transverse dark-brown lines or dark spots, except in *N. fea* which has all legs entirely dark brown (fig. 15C). Femora with few setae, other segments increasingly hirsute after tibiae. Macrosetae few and present on all segments except tarsus. Epigynum flat, rectangular in shape and wider than long; copulatory openings visible in ventral view and located laterally on the epigynal plate (figs. 10A, B, 11A, B, 14D); size and shape of these openings are species diagnostic. Copulatory ducts modified as membranous sacs that connect to spermathecae via two longitudinal sclerotized ducts (fig. 13E). Spermathecae sclerotization variable, but differentiated from the "copulatory sacs" by a cluster of accessory gland ducts (figs. 20H, 23C, D). Fertilization ducts short, well sclerotized, and originating near the cluster of accessory gland ducts (figs. 13E, 23C).

Male same as female except as noted. Total length 2.0–8.1. Cephalothorax length 1.0–3.2, width 0.8–2.0. Carapace dorsal coloration lighter than female. Clypeus height 1.0–1.5 AME diameter. Chelicerae slightly longer and narrower apically, dorsal cuticle smooth, becoming rugose toward ectal and apical surfaces (figs. 9I, 14I, 26I); ventral cuticle without stridulatory organs (fig. 21H). Abdomen pattern as in female but

lighter. Legs: Femur I length 1.6–10.1. Coloration and patterns weaker than in female. Pedipalp: Tibia triangular in shape and usually longer than wide, 1.4–3.75 times, apical margin wider (figs. 13A, 19A). CEBP with one to three apophyses, paracymbium hook or finger shaped either hirsute or glabrous; CEMP small, apical portion as a rounded blunt apophysis; cymbial distal process variable in size and shape (figs. 13C, 15D, 29C). Tegulum donut shaped and compressed dorsoventrally. Embolus and conductor attachment membranous, at the center of the tegulum (figs. 13A, B, 22A, B). Conductor spirals clockwise, margins heavily sclerotized, middle section membranous and expandible (figs. 10C–F, 13A, B). Conductor apical apophyses of variable shape (figs. 10C, D, 19A–C, 23G, H).

Composition: *Nanometa gentilis, N. trivittata, N. lagenifera, N. sarasini, N. purpurapunctata, N. tasmaniensis, N. fea, N. tetracaena, N. dutrorum, N. forsteri,* and *N. dimitrovi* (all presented in the current paper), as well as the taxa formerly included in *Nediphya*: *Nanometa hippai* comb. nov., *N. lehtineni* comb. nov., *N. lyleae* comb. nov., and *N. padillai* comb. nov. Several small sized *Nanometa* species remain undescribed; the species diversity of the smaller species seems to exceed that of the larger (perhaps more conspicuous and frequently collected) taxa.

Systematics: The monophyly of *Nanometa* is supported by the following morphological synapomorphies: branched median tracheal trunks (figs. 11D, 30D); males with a sclerotized ridge on the anterior part of the booklung cover, presumably part of a stridulatory organ with a plectrum on the fourth coxae consisting of small teeth (figs. 20F, 30C) (Forster and Forster, 1999; Álvarez-Padilla and Hormiga, 2011); absence of embolic apophysis; conductor morphology as a curved, flattened translucent disk, with an enlarged and folded margin that covers the embolus distal part (figs. 10C, D, 11E, F, 13C); and copulatory ducts modified as sacs (figs. 9H, 11C, 13E). Kallal and Hormiga's (2018) recent phylogenetic analysis included both large and small *Nanometa* species and supported the monophyly of the genus. These authors also found *Pinkfloydia* to be sister to a clade with remaining nanometines, with good support (Kallal and Hormiga, 2018). The analysis of Dimitrov et al. (2017) suggested that *Taraire* (see description below) is sister to Nanometinae but with low support. Our analysis elaborates on that latter work, focusing on *Nanometa* and other tetragnathid taxa found in Australia, New Zealand, New Caledonia, and Papua New Guinea.

Etymology: Simon did not explain this genus name, but very likely it means the dwarf *Meta,* a common etymological root in Tetragnathidae referencing the genus *Meta.*

Distribution: *Nanometa* species are distributed throughout Australasia, and many seem to be endemic to the islands included in this region. *Nanometa trivittata* and *N. dimitrovi* are found only in eastern Australia; *N. tasmaniensis* is found only in Tasmania; *Nanometa tetracaena* and *N. dutrorum* are found in Tasmania and mainland Australia (fig. 37). *Nanometa sarasini* is endemic to New Caledonia; *N. purpurapunctata, N. lagenifera,* and *N. dimitrovi* are found only in New Zealand; and species from Papua New Guinea include *N. fea, N. hippai, N. lehtineni, N. lyleae* and *N. padillai.*

Natural History: *Nanometa* species build horizontal or vertical orb webs with open hubs in humid habitats, sometimes close to or over water bodies, such as streams. When resting, the front legs are stretched forward in a characteristic posture while the rear legs are directed caudally (figs. 1A, C, D, 2B, C, 3C, D) (Forster and Forster, 1999; and all authors personal obs.). They occur in climates ranging from equatorial tropics to temperate forests.

Remarks: The genus *Nanometa* was erected by Simon (1908) to include a small tetragnathid species from Western Australia; until now, the genus has remained monotypic. In an unpublished manuscript, the late Ray F. Forster planned to describe at least 40 additional species from eastern Australia, New Zealand and New Caledonia among other Australasian islands, but he passed away before his work was finished. Urqu-

hart (1891: 1951) erected the genus *Erycina* to accommodate a single species (*Erycina violacea* Urquhart, 1891) unaware that he had already described two conspecifics under two different names (*Linyphia purpurapunctata* Urquhart, 1889, and *Linyphia nitidulum* Urquhart, 1889). Urquhart's new genus name was preoccupied in Lepidoptera, Mollusca, and Reptilia, and so Strand (1912) provided *Ericyniolia* as a replacement name for *Erycina*. Urquhart (1891) did not give a justification for erecting the new genus nor did he provide a diagnosis. Forster (1980) and Forster and Forster (1999) placed *Ericyniolia* within nanometines (as "Eryciniolinae" in the former and "Nanometidae" in the latter work). Our phylogenetic analysis places *Ericyniolia purpurapunctata* in a clade of *Nanometa* species (figs. 61–63), including the type species, *N. gentilis*. We circumscribe *Nanometa* as a monophyletic group that includes *purpurapunctata*, and thus *Ericyniolia* becomes a junior synonym of *Nanometa* (maintaining *Eryciniolia* as a separate genus would render *Nanometa* paraphyletic).

More recently, Marusik and Omelko (2017) erected the new genus *Nediphya* to group four tetragnathid species from Papua New Guinea. Only in the type species of *Nediphya* are both sexes known, with the remaining three species described from females only. Marusik and Omelko (2017: 205) placed *Nediphya* within Nanometinae based on the "complicated morphology of the copulatory organs." They also considered that, based on the morphology of the copulatory organs, *Pinkfloydia*, *Eryciniolia*, "*Orsinome*" *sarasini* (= *Nanometa tasmaniensis*), and "*Orsinome*" *lagenifera* (= *Nanometa lagenifera*) could not be placed in Nanometinae. We agree with Marusik and Omelko's (2017) assessment that the genitalia of *Nediphya* are very similar to those of "*Orsinome*" *sarasini* and "*Orsinome*" *lagenifera* (these latter two taxa now placed in *Nanometa*).

Marusik and Omelko (2017) provide no explicit phylogenetic arguments in neither their comments nor justification of higher taxa. The unusual eye pattern and spination of legs I and II of *Nediphya* are highlighted in their discussion, where they conclude that the similarities between *Nediphya* and *Diphya* do not reflect ancestry (and thus must be convergently evolved) and that genitalic morphology better resolves their phylogenetic affinity. We agree with this assessment and, although we do not have DNA sequence data for *Nediphya*, the genitalic morphology clearly suggests that this genus is part of the *Nanometa* clade. The eye arrangement of *Nediphya* in three rows with nonjuxtaposed lateral eyes is unusual in the genus *Nanometa*, but it should be noted that *Nanometa purpurapunctata* also has an atypical ocular arrangement (Bryant, 1933: fig. 33), with distantly separated lateral eyes. The eye pattern of the nanometine genus *Pinkfloydia* is also unusual, due to the enlarged PMEs on conspicuous tubercles (Dimitrov and Hormiga, 2011; Hormiga, 2017). Despite the unusual eyes, both *Nediphya* and *Nanometa purpurapunctata* have the typical genitalic morphology found in all *Nanometa* species.

The other peculiar character of *Nepdiphya* is the promarginal row of stiff setae on legs I and II (Marusik and Omelko, 2017). A similar arrangement can also be found in some *Nanometa* species (e.g., in *N. purpurapunctata*, *N. dimitrovi*, and *N. tetracaena*). Unfortunately, the tracheal morphology of *Nediphya* remains unknown, and the SEM image of the booklung cover of the only known adult male in the genus (Marusik and Omelko, 2017: fig. 22) does not reveal whether the typical sclerotized anterior margin is present (although the authors report the ridges as absent).

Three putative morphological synapomorphies support the inclusion of *Nepdiphya* in *Nanometa*. The first one is the absence in both genera of an embolic apophysis, which is present in the sister genus of *Nanometa* (*Pinkfloydia*) and in other tetragnathids such as *Allende*, *Tawhai*, *Taraire*, and *Chrysometa*. The second is the conductor morphology as a curved, flattened, translucent disk, with an enlarged and folded margin that covers the embolus distal part. *Pinkfloydia* has a conductor that resembles that of *Allende* and some Metainae have it not flattened, more sclerotized, and projected apically as it curves

with the embolus (Álvarez-Padilla and Hormiga, 2011; Dimitrov and Hormiga, 2011). A third putative synapomorphy is the presence of copulatory ducts modified as sacs, which gives the internal female genitalia of *Nanometa* the appearance of having four chambers. In the absence of any evidence of synapomorphic support for a clade that would include all *Nanometa* species but not *Nediphya*, we synonymize the latter genus under the former.

Nanometa gentilis Simon, 1908

Figures 7–8, 37

Nanometa gentilis Simon, 1908: 421. Dalmas, 1917: 369, figs. 36–37.

TYPE MATERIAL: Male, female, and immature syntypes. Australia Occidentale (Michnerd), specimen code 23887, deposited at the Muséum National d'Histoire Naturelle (examined and photographed). One juvenile syntype from Western Australia, Lion Hill (= Mt. Helena), -31.883, 116.2. W. Michaelsen and R. Hartmeyer, 10 November 1905. WAM T159.

DIAGNOSIS: *Nanometa gentilis* shares with *N. forsteri* a long CEBP apophysis; however, in the Australian species the apophysis is shorter and its tip bent apically in dorsal view (fig. 8A–C). *Nanometa gentilis* also has a thin apophysis, not found in similar species, that subtends this larger apophysis (fig. 8A). Both species have a conductor that is C-shaped apically (similar to many other *Nanometa* species), however, in *N. gentilis* the basal apophysis is narrower and more acute than in *N. forsteri* (figs. 8A–C, 35A–C). Females of *N. gentilis* can be separated from other small *Nanometa* species by having circular and deep genital openings half of the epigynum width, located on the posterior half of the epigynal plate and separated by a rectangular septum, almost the same size as these openings (figs. 7E, 8D, E).

DESCRIPTION: Male (GH0114): Total length ca. 2.6 (cephalothorax and abdomen detached). Cephalothorax length 1.1, width 0.8. Clypeus height 1.0 AME diameter. Cephalothorax background pale yellow with pattern of pair of dark gray parallel lines that converge in the fovea and the carapace lateral edges. Endites and sternum color dark brown. Cheliceral promargin and retromargin with three and two teeth respectively, cheliceral denticles present. Abdomen dorsum background light gray, silvery guanine patches conspicuous and covering the anterior half of abdomen except medial line, lateral surface covered with guanine patches over dorsal half, ventral half with brown pattern, ventral surface with a central brown rectangle, flanked by a line of silvery guanine patches. Stridulatory organ formed by a cuticular ridge highly sclerotized on booklung anterior edge, coxa IV retrolateral not examined with SEM. Femur I length 2.0. CEMP square in shape and ca. 1/4 of the cymbium length. Conductor distal apophyses surface smooth, tip C-shaped (figs. 7B, F, H, 8A–C).

Female (WAM T24691, T24689): Total length 4.0. Clypeus height approximately the same as the AME (measurements taken from Simon, 1908, description). Cephalothorax and abdomen coloration darker than in male (fig. 7A, C). Epigynum plate one third wider than long, anterior margin rounded (figs. 7E, 8D).

REMARKS: Simon's original description mentions that there were several specimens from other localities cited as follow: "Stat. 99, Lion Mill: Stat. 100, Lion Mill (propter aquae rivum); Stat. 150. Yallingup: Stat. lös, Broome Hill; Stat. 1 (57, South Albany." We were able to locate only a juvenile from this location.

MATERIAL EXAMINED: $N = 8$. AUSTRALIA: Western Australia: Barrabup Road, W. of Nannup, 33° 58′ 59.88″ S, 115° 45′ 0″ E, M.S. Harvey & T.J. Deog, 9 January 1985, at temporary pool, 1 male, 1 juvenile. WAM T20877; 8 km W. of Kirup, 33° 43′ 59.88″ S, 115° 49′ 0.12″ E, M.S. Harvey & T.J. Doeg, 9 January 1985, 1 juvenile, WAM T20879; Lake Poorginup, 34° 32′ 60″ S, 116° 43′ 59.88″ E, M.S. Harvey & J.M. Waldock, 24 April 1990, 1 male, WAM T24687; Mount Chudalup, 34° 45′ 59.76″ S, 116° 4′ 59.88″, M.S. Harvey & J.M. Waldock, 5 January 1990, 1 male, 1 female, WAM

T24688; Pemberton, youth hostel, 34° 23′ 60″ S, 115° 58′ 0.12″, M.S. Harvey & J.M. Waldock, 5 January–5 February 1990, 1 male, 1 juvenile, WAM T24689; Torndirrup National Park, Quaranup Road, 35° 4′ 59.88″, 117° 55′ 0.12″, M.S. Harvey & J.M. Waldock, 24 April 1990, 1 female, WAM T24691; Western Australia, Two Road, Walpole-Nornalup National Park, 11.1 km W. Walpole, 34° 57′ 55.6″ S, 116° 36′ 23.8″ E, 30 m. G. Hormiga, L. Lopardo, 26 February 2006, eucalypt forest and open heathland, 1 male deposited at GWU (DNA voucher, GH0114).

DISTRIBUTION: This species is endemic to southwestern Western Australia (fig. 37B).

Nanometa trivittata (Keyserling, 1887), comb. nov.
Figures 3, 9–13, 37

Meta trivittata Keyserling, 1887: 213, pl. 19, fig. 4.
"Nanometinae sp." Álvarez-Padilla and Hormiga, 2011: 74, figs. 71–76 (SEMFAP049).

TYPE MATERIAL: Female holotype likely destroyed (R. Raven, personal commun.). Specimen originally deposited at the Museum Godeffroy (ceNAK), Sydney; from Mr. Bradley's collection, Cape York. Drawings and description are considered accurate for specimen identification.

DIAGNOSIS: The broad and caudally straight epigynal septum (figs. 9D, 13D), the shape of the conductor apex and CEBP (figs. 10C, F, 13A–C) are unique to this species. In addition, *Nanometa trivittata* can be differentiated from other large *Nanometa* species by the following unique combination of characters: epigynum flat, genital openings large and separated by a wide septum ca. one half epigynum width, posterior middle section excavated with a pit of variable depth (figs. 9B, D, 10A, B, 13D). Median plate trapezoidal with ventral side wider (fig. 10A). CEBP has one long apophysis with a round tip and a tiny sclerotized basal spine (fig. 10C, F). CEMP an arc-shaped cuticular ridge (fig. 10C–E), tip separated from the cymbium, hook shaped and bent ca. 90° (fig. 10E). Cymbium distal margin protruded and finger shaped (fig. 10E, F).

DESCRIPTION: Female (TEAU003) total length 5.6. Cephalothorax length 2.1, width 1.6. Clypeus height 0.84 AME diameter. Cephalothorax background yellow, dark brown on the cephalic area and carapace edges (fig. 9A, C). Eyes subequal in size, lateral smaller. Sternum brown (fig. 9E). Cheliceral promargin and retromargin with three and two teeth respectively, ca. five chelicerал denticles. Abdomen dorsum background dark gray, most guanine patches forming a medial line divided into four to six lateral lobes delineated by dark-brown chevrons, lateral areas of the abdomen dorsum with intercalated areas of guanine patches and dark-brown spots (fig. 9A). Lateral line of guanine patches complete (fig. 9C). Ultrastructure of abdomen, tracheae, and spinnerets (figs. 11D, 12A) observed with SEM. Abdomen cuticle flat reticulated; median tracheal trunks branched, lateral tracheae tube shaped (fig. 11D). ALS with one major ampullate, one nubbin, ca. 60 piriform, tartipores present (fig. 12B). PMS with one nubbin, one minor ampullate, one cylindrical, and three central aciniform spigots (fig. 12C). PLS araneoid triplet spigots tips clustered together, ca. 12 aciniform spigots distributed in two parallel rows, two cylindrical gland spigots at the periphery (fig.12D). Femur I length 3.36. Copulatory ducts modified as membranous sacs with smooth cuticle (figs. 9H, 11C, 13E), spermathecae and "copulatory sacs" sclerotization variable (fig. 9F, H) accessory duct glands clustered on the internal surfaces (fig. 11C). Description based on specimens (TEAU003, TEAU006, TEAU008, TEAU023, TEAU035).

Male (TEAU036): Same as female except as noted. Total length 4.23. Cephalothorax length 2.0, width 1.5. Clypeus 0.95 AME diameter (fig. 9I). Cephalothorax and abdomen coloration lighter than in female, sternum coloration yellow. Cheliceral denticles ca. six. Booklung covers and coxa IV surfaces examined with SEM. Stridulatory organ formed by a thin cuticular ridge on booklung anterior edge, opposite to several cuticular

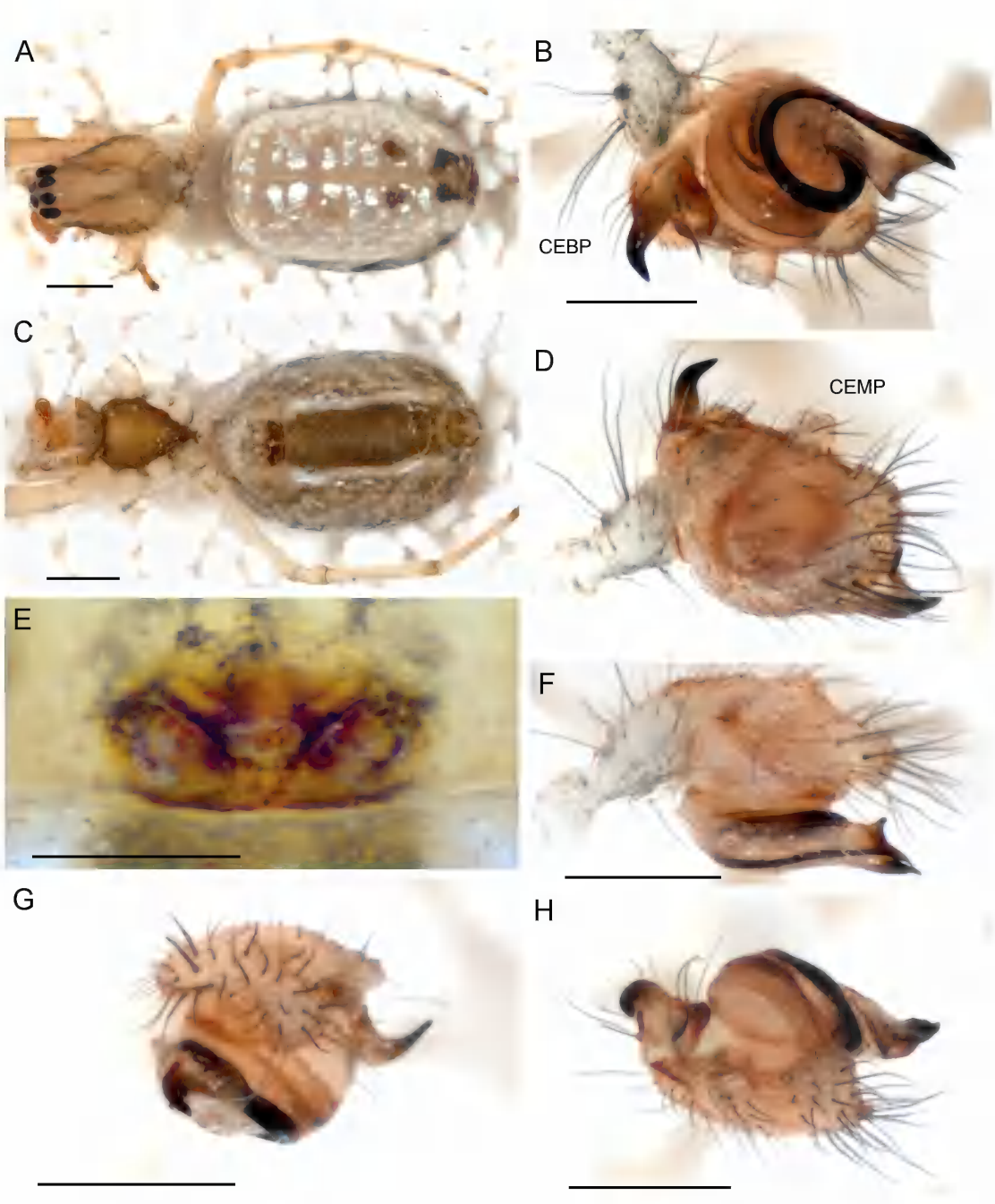

FIGURE 7. *Nanometa gentilis* (male: WAM T24687; female: WAM T24689). **A.** Female, dorsal habitus. **B.** Male, ventral pedipalp. **C.** Female, ventral habitus. **D.** Male, dorsal pedipalp. **E.** Epigynum, ventral. **F.** Male, mesal pedipalp. **G.** Male, apical pedipalp. **H.** Male, ectal pedipalp. Scale bars: A, C, F, 0.5 mm; B, D, G, H, 0.25 mm; E, 0.2 mm.

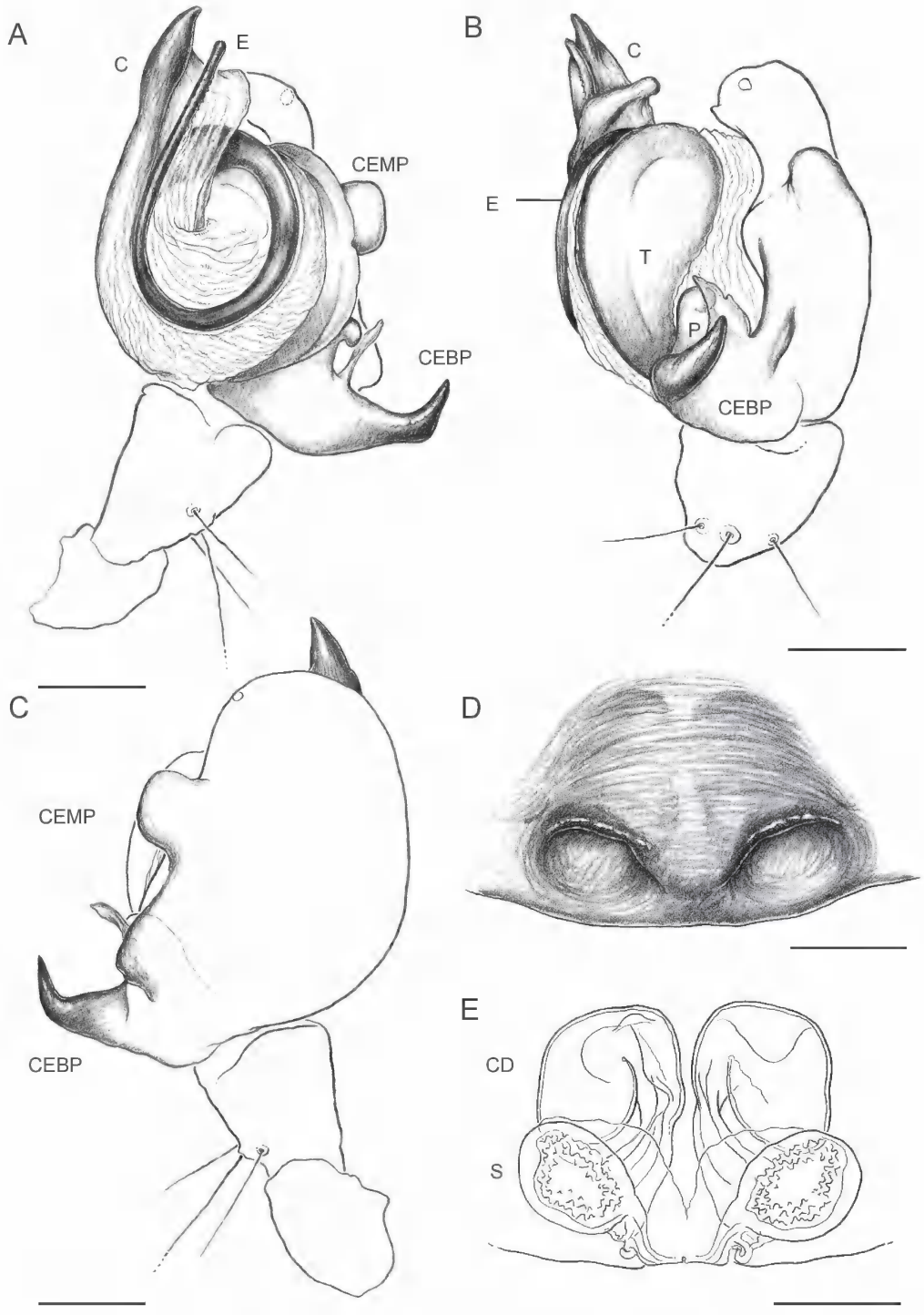

FIGURE 8. *Nanometa gentilis* (male: GH0114; female: WAM T24689). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: 0.1 mm.

ridges on coxa IV retrolateral surface. Femur I length 4.73. Basal apophysis of conductor tip slender and as long as the distal apophysis, distal apophysis thicker, heavily sclerotized and ending in a curved tip (figs. 11E, F, 13A–C). Description based on specimens (TEAU004, TEAU036).

VARIATION: Females ($N = 7$) total length 5.3–7.2, cephalothorax length 2.1–2.8, width 1.6–2.2. The depth of the median septum pit varies from almost flat to considerably deep. Males ($N = 6$) total length 3.4–6.5, cephalothorax length 2.0–3.2, width 1.3–2.4. CEBP apophysis tip varies in shape from a rounded spatula to a broken tip. Conductor tip apophyses vary in length and orientation angle.

DISTRIBUTION: This species can be found in tropical, subtropical, and temperate regions of eastern Queensland, New South Wales, and Victoria (fig. 37C).

NATURAL HISTORY: *Nanometa trivittata* builds vertical ($n = 2$) or horizontal ($n = 1$) orb webs, with relatively few radii (13–14; $n = 3$) and few loosely spaced radii (fig. 3C, D). The hub is open.

MATERIAL EXAMINED: $N = 144$. AUSTRALIA: New South Wales: 4 km W of Washpool State Forest, 29° 15′ 51.89″ S, 152° 22′ 41.53″ E, 684 m, 1 male, 1 immature, AM KS9334; Border Ranges National Park, Brindle Creek Rd, 28° 22′ 42.2″ S, 153° 4′ 9.4″ E, 713 m, G. Hormiga & N. Scharff, 22–23 March 2010, temperate rainforest, general collecting at night, 8 females, 2 males, 3 immatures (1 female illustrated by G. Hormiga, 1 female image and description voucher TEAU023, 1 female for SEM voucher TEAU033, 1 female epigynum variation voucher TEAU006) GWU; Bow Cave, Jenolan, 33° 49′ 6.12″ S, 150° 1′ 19.4″ E, 844 m, G. Smith, 15 May 1988, 2 males, 1 female, AM KS19045; Jamberoo Mountain, 34° 39′ 6.34″ S, 150° 41′ 40.56″ E, 613 m, J. Noble, 23 December 1995, 1 female, AM KS53629; Ku-Ring-Gai Chase National Park, McCarr's Creek, 33° 37′ 53.62″ S, 151° 15′ 14.42″ E, 167 m, D.J. Bickel, 22 November 1986, 1 female, AM KS32217; Macquarie Pass National Park, Cascades Rainforest walk, 34° 34′ 1.4″ S, 150° 40′ 22.6″ E, 127 m, G. Hormiga & N. Scharff, 15 March 2010, 2 females, GWU; Macquarie Pass National Park, Clover Hill Rd, 34° 33′ 51.6″ S, 150° 38′ 59.3″ E, 214 m, G. Hormiga & N. Scharff, 16 March 2010, 1 female, sifted litter (image voucher TEAU008); New England National Park, Wright's Lookout Trail, 30° 30′ 17.21″ S, 152° 24′ 9.82″ E, 1300 m, A. Newton & M. Thayer, 27 February–6 March 1980, *Nothofagus moorei* rainforest, tree ferns, pyrethrin fogging, 1 male, AMNH; Port Macquarie, Sea Acres Nature Reserve, 31° 28′ 0″ S, 152° 56′ 0″ E, 0–10 m, G. Williams, 26 January–13 February 1999, subtropical rainforest, malaise trap, 1 male, AM KS58338; Toonumbar National Park, Iron Pot Creek, Hanrahans Rest, 28° 28′ 0″ S, 152° 53′ 0″ E, 105 m, D. Bickel, 17–18 December 1998, rainforest, yellow pans, 1 male, AM KS59114; Werrikimbe National Park, Cobcroft Park, 31° 13′ 0″ S, 152° 11′ 0″ E, 1010 m, D. Bickel, 17–18 November 1998, rainforest, sweeping, 1 male, AM KS59043; Blue Mountains National Park, Mount Wilson, -33.49882, 150.41474, 955 m, G. Hormiga & N. Scharff, 3 April 2014, GH1663. Queensland: 7 km SW Kenilworth, Yabba Creek Forest, 26° 37′ 7.77″ S, 152° 39′ 28.18″ E, 150 m, S. Peck & J. Peck, 18 June–15 August 1982, wet sclerophyll FIT, 2 females, AMNH; Atherton Tablelands, Dambulla National Park, Mobo Creek Walk, 17° 10′ 15.8″ S, 145° 38′ 23.8″ E, 716 m, G. Hormiga, N. Scharff, & J. Pedersen, 14 February 2012, 1 female, 3 immatures (DNA voucher GH1152) GWU; Tully Falls National Park, S of Ravenshoe, Charmillin Creek, Wabunga Wayemba, 17° 42′ 0.8″ S, 145° 31′ 20.8″ E, 931 m, G. Hormiga, N. Scharff, & J. Pedersen, 12 February 2012, rainforest walkabout, general collecting 1 female (DNA voucher GH1150) GWU; Bellenden Ker Range, NQ Cable Tower 3, 17° 15′ 29.85″ S, 145° 50′ 7.83″ E, 1054 m, 17–24 October 1981, 1 female, QM S26353; Eungella, Schoolhouse, 21° 8′ 0″ S, 148° 29′ 0″ E, 701 m, R. Raven & J. Gallon, 11–15 February 1986, rainforest, general collection, 1 female, QM S7043. Eungella, Schoolhouse, 21° 8′ 0″ S, 148° 29′ 0″ E, 701 m, R. Raven & J. Gallon, 11–15 February 1986, rainforest, general collection, 2 males, 3 females,

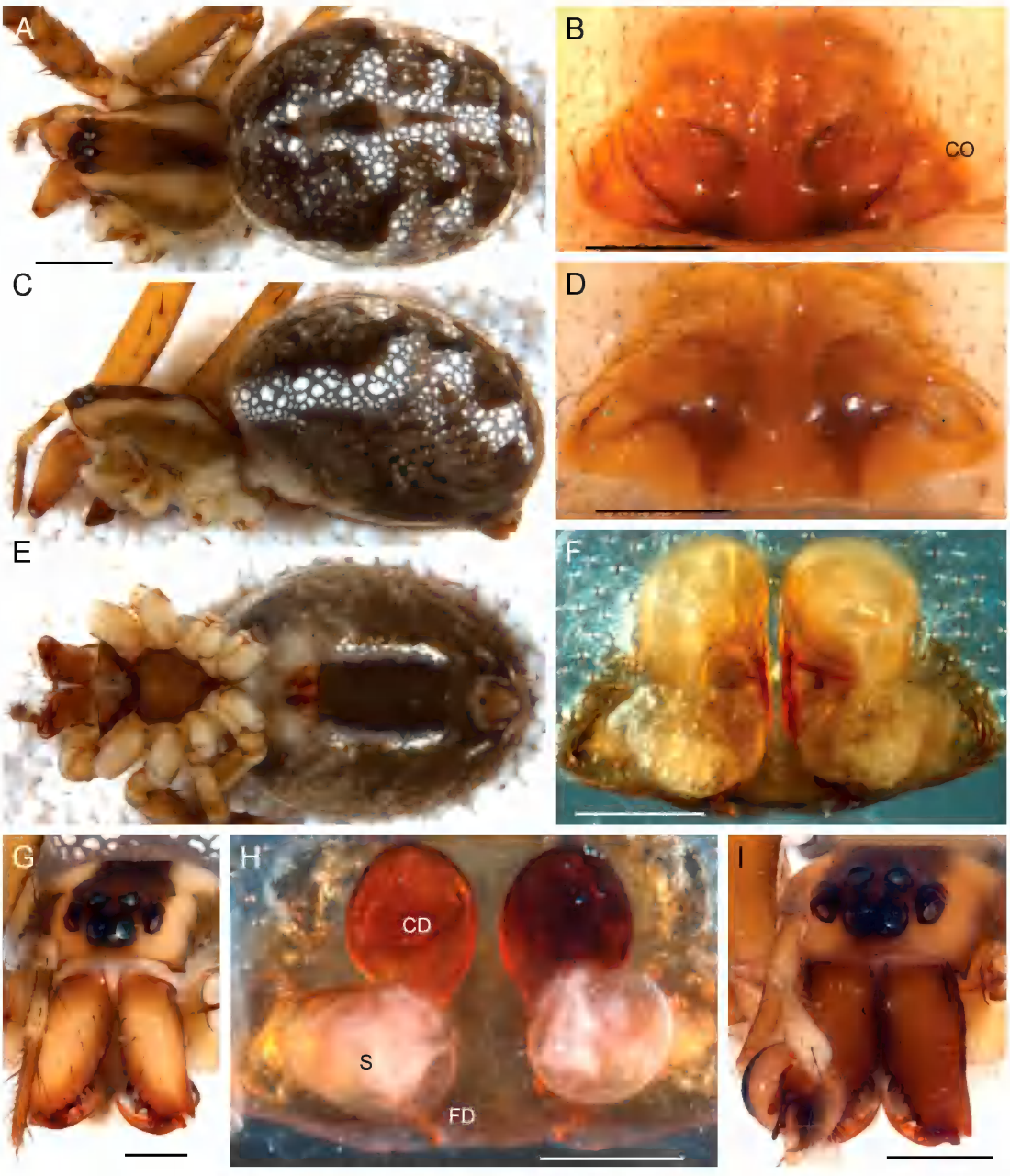

FIGURE 9. *Nanometa trivittata* (female: TEAU006; male: TEAU004). **A.** Female, dorsal habitus. **B.** Epigynum, ventral. **C.** Female, lateral habitus. **D.** Epigynum, posterior or caudal. **E.** Female, ventral habitus. **F.** Epigynum, dorsal cleared. **G.** Female, frontal. **H.** Epigynum, dorsal digested. **I.** Male, frontal. Scale bars: A, C, F, 1.0 mm; B, D, F, H, 0.2 mm; G, I, 0.5 mm.

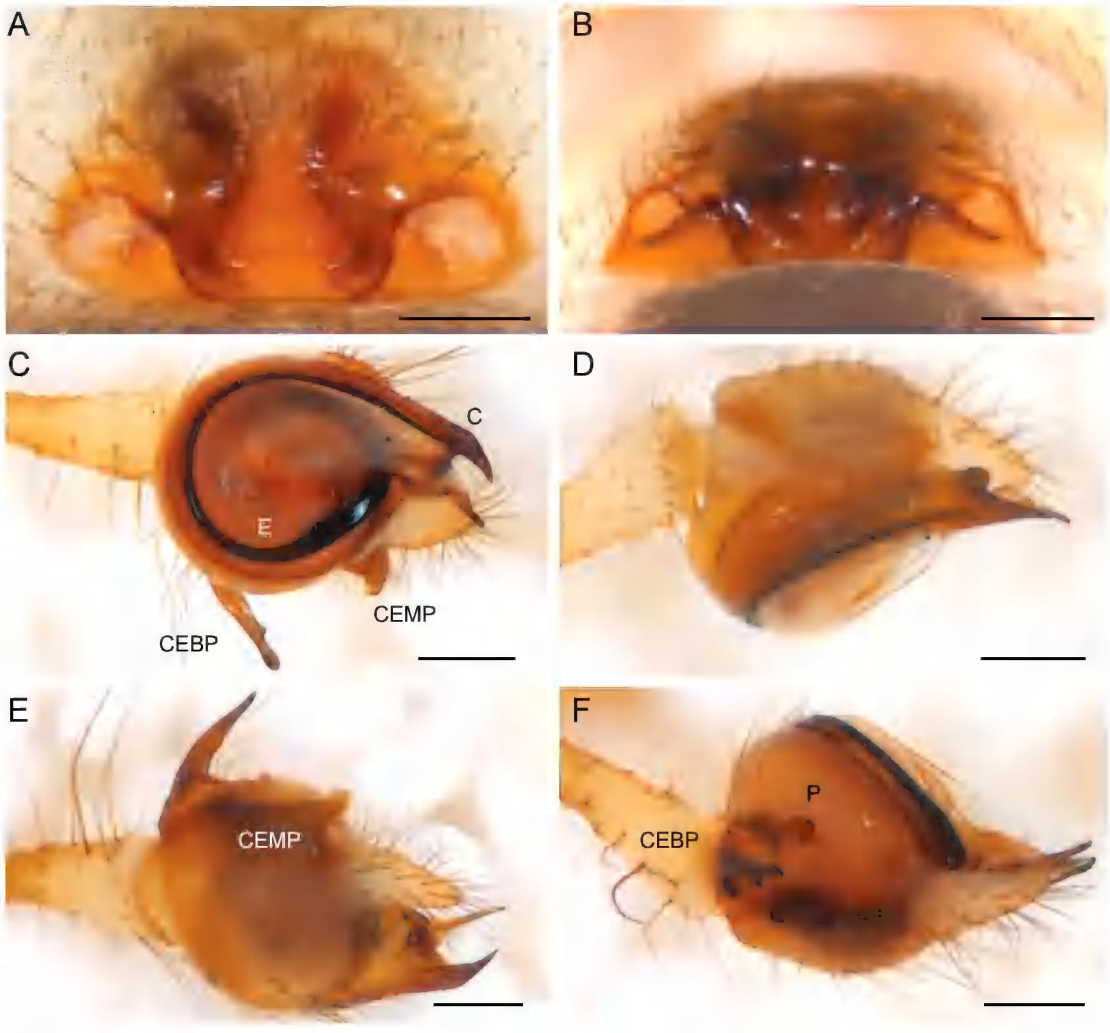

FIGURE 10. *Nanometa trivittata* (male: TEAU004; female: TEAU006). **A.** Epigynum, ventral. **B.** Epigynum, caudal. **C.** Pedipalp, ventral. **D.** Pedipalp, mesal. **E.** Pedipalp, dorsal. **F.** Pedipalp, ectal. Scale bars: 0.2 mm.

6 immatures QM S7056; Mount Hypipamee National Park, The Crater, 17° 25′ 35.8″ S, 145° 29′ 8.9″ E, 910 m, D. Bickel, 13–27 April 1994, rainforest, pans collecting, 1 male, AM KS45010; Cedar Creek, via Samford, 27° 26′ 5.44″ S, 152° 59′ 54.37″ E, 24 m, R. Raven & J. Gallon, 5 February 1986, 1 male, 4 females, QM S58348; Lamington National Park, tracks nr. O'Reilly's, 28° 14′ 5″ S, 153° 8′ 13″ E, 920 m, G. Hormiga, M. Kuntner, & F. Álvarez-Padilla, 13–17 April 2002, rainforest, 25 females, 3 male, 16 juveniles (SEM 2 females image voucher TEAU035, 1 female image voucher TEAU003; 1 male image voucher TEAU004; SEM male palp expanded image voucher TEAU036); Lamington National Park, near O'Reilly's Guesthouse, Python Rock Lookout Trail, 28° 13′ 32.1″ S, 153° 7′ 34.7″ E, 844 m, G. Hormiga & N. Scharff, 23 April 2011, 1 male (measurements voucher FAPM008) GWU; Lamington National Park, road Canungra-O'Reilly's, 28° 8′ 25″ S, 153° 6′ 55″ E, 750 m, G. Hormiga, M. Kuntner, F. Álvarez, 15–17 April 2002, dry

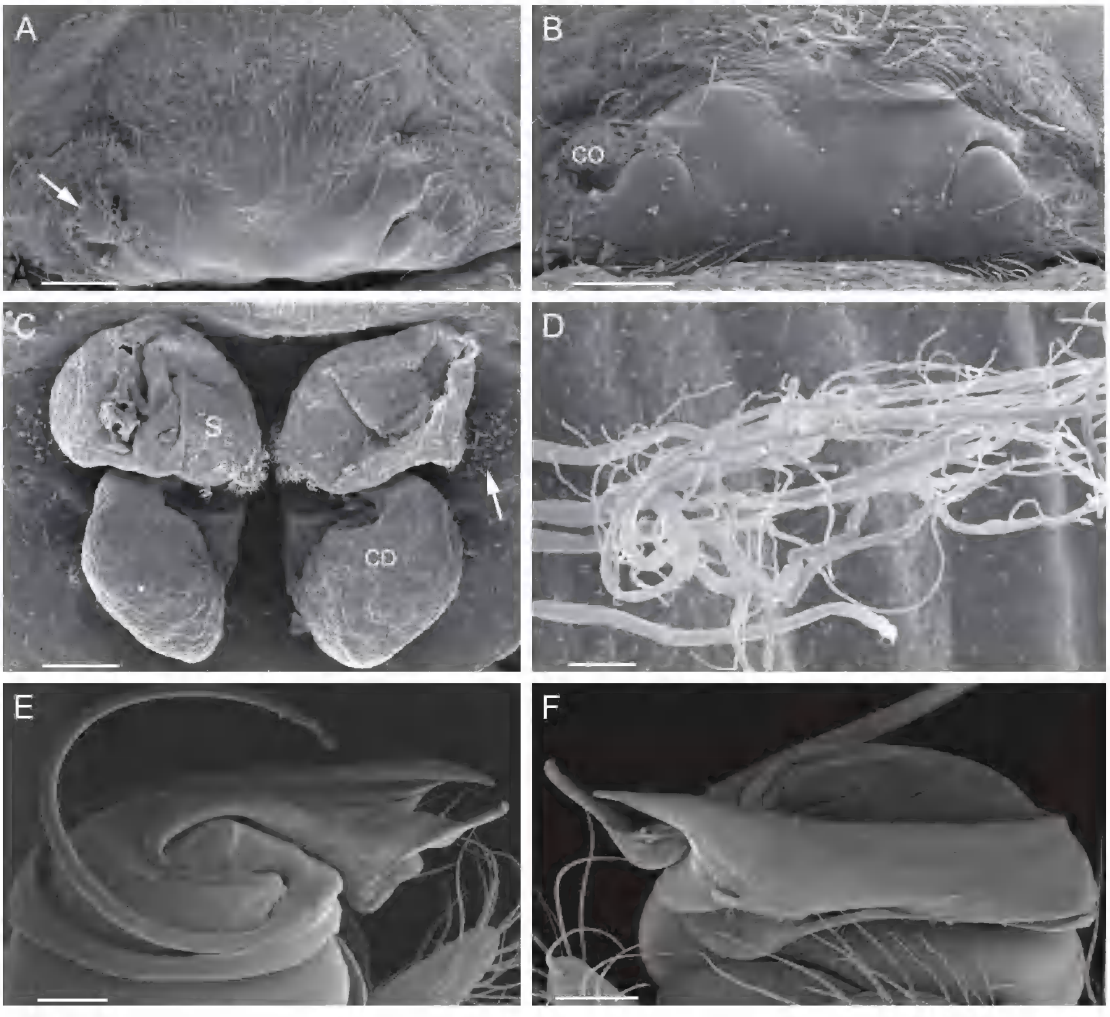

FIGURE 11. *Nanometa trivittata* (TEAU035). **A.** Epigynum, ventral; arrow indicates genital opening. **B.** Epigynum, caudal. **C.** Epigynum, dorsal. **D.** Tracheae. **E.** Pedipalp, ectal detail. **F.** Pedipalp, mesal detail. Scale bars: 0.1.

forest (SEM 1 male palp voucher TEAU034); Lamington National Park, 28° 14′ 0″ S, 153° 8′ 0″ E, 900 m. T. Churchill 6 February 1991, *Nothofagus* forest, 1 female QM S25430. Victoria: Grey River, Otway Range, 38° 41′ 3.81″ S, 143° 50′ 21.29″ E, 15 m, D.F. King, 15 February 1974, rainforest, lattice web across river, 1 female, AMS KS20994; Warburton, Cement Ck, 37° 42′ 33.8″ S, 145° 43′ 33.61″ E, 670 m, A. Newton & M. Thayer, 10–17 January 1980, *Nothofagus cunninghamii*, etc, ex wet moss over forest stream, AMNH; Warburton, Cement Ck, 37° 42′ 33.8″ S, 145° 43′ 33.61″ E, 670 m, A. Newton & M. Thayer, 16 January 1980, on and under rocks in stream, AMNH; Great Otway National Park, Maits Rest rainforest, 38° 45′ 17.85″ S, 143° 33′ 17.69 E, 215 m, G. Hormiga & N. Scharff, 14–15 April 2014, 1 female, 2 juveniles, GWU; Drummer Rainforest, *ca.* 10 km E of Cann River, 37° 34′ 3.47″ S, 149° 16′ 20.82″ E, 145 m, G. Hormiga & N. Scharff, 7 –8 April 2014, 1 male, 1 female, 1 juvenile, GWU; Phillips Track, Young;s Creek crossing, 0.5 km N of Triplet Falls, 38° 40′ 00″ S, 143° 28″ 60.0″ E, G. Milledge, 17 March

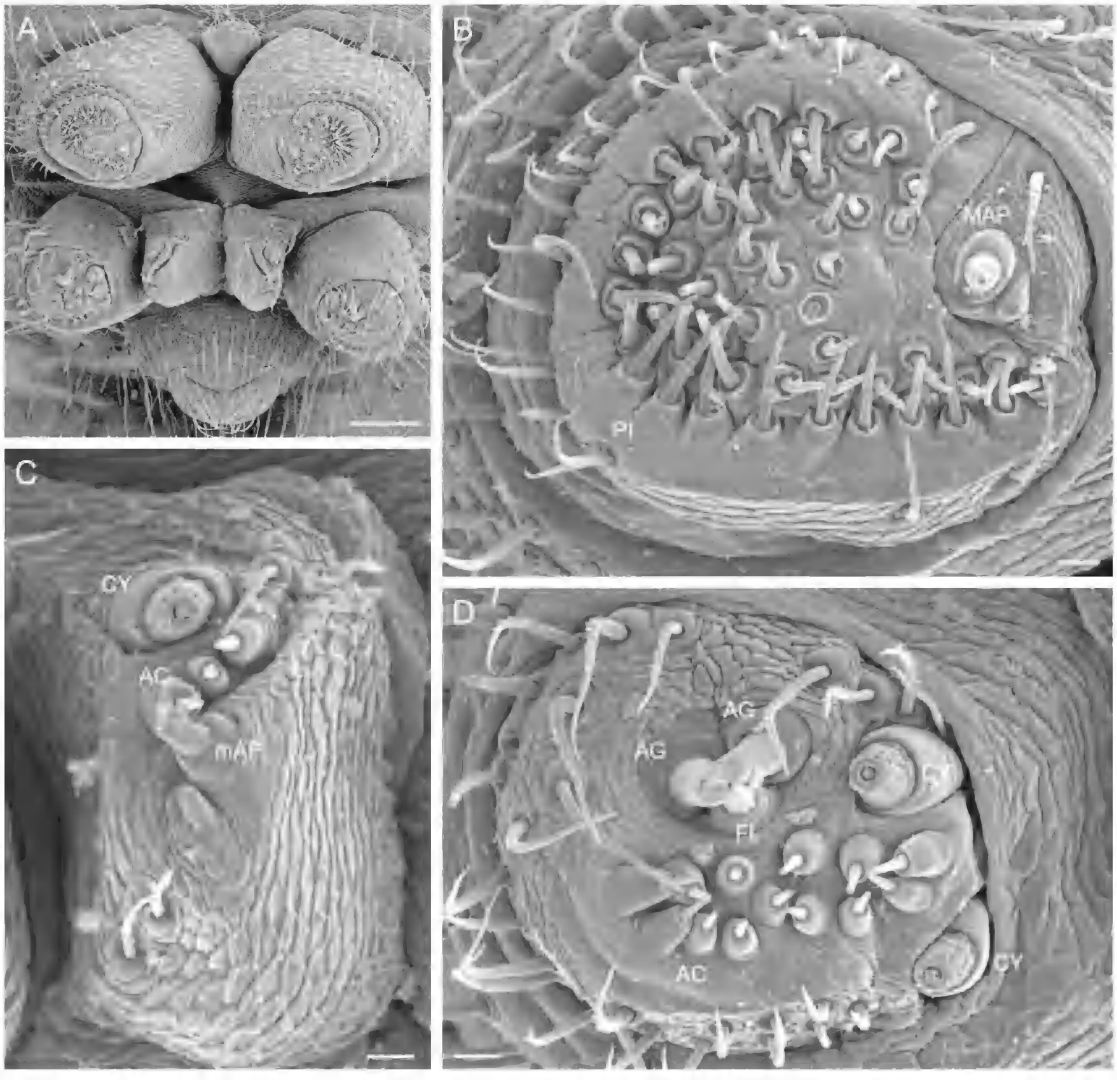

FIGURE 12. *Nanometa trivittata* (TEAU035). **A.** Spinning apparatus. **B.** ALS. **C.** PMS. **D.** PLS. Scale bars: A, 0.1 mm; B–D, 0.01 mm.

1991, *Nothofagus cunninghami* forest, direct search, NMV; Phillips Track, Young's Creek crossing, 0.5 km N of Triplet Falls, 38° 40′ 00″ S, 143° 28″ 60.0″ E, G. Milledge, 30 January 1995, *Nothofagus cunninghami* forest, direct search, 3 males, 10 females, 10 juveniles, NMV K-6320; Phillips Track, Young's Creek crossing, 0.5 km N of Triplet Falls, 38° 40′ 00″ S, 143° 28″ 60.0″ E, G. Milledge, 31 January 1995, *Nothofagus cunninghami* forest, direct search, 2 females, NMV K-6322; Cement Creek, A. Neboiss, 5 February 1995, 2 females, 2 juveniles, NMV; Strzelecki Ranges, Tarra-Bulga National Park, 0.5 km NNE of Tarra Valley Picnic Area, -38.4444444, 146.5416667. G. Milledge, 14 September 1995. *Nothofagus cunninghami* forest, direct search. 4 males, 2 females, 6 juveniles. NMV K-6325. Strzelecki Ranges, Tarra-Bulga National Park, 0.5 km NNE of Tarra Valley Picnic Area, -38° 26′ 40″ S, 146° 34′ 20.0″ E, G. Milledge, 10 January 1996, *Nothofagus cunninghami* forest, direct search, NMV K-6329; Strzelecki Ranges, Tarra-

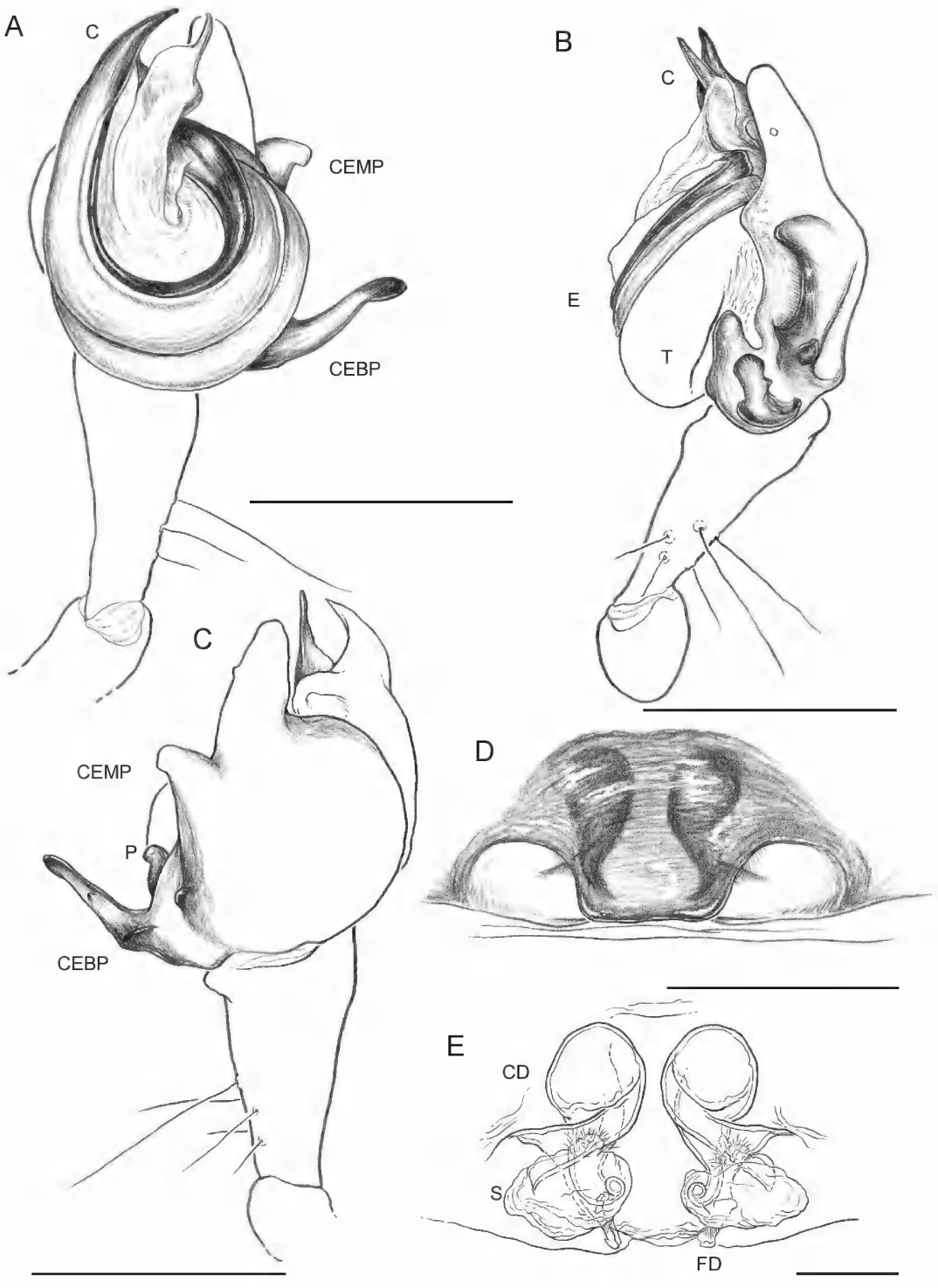

FIGURE 13. *Nanometa trivititta* (TEAU023). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–D, 0.5 mm; E, 0.2 mm.

Bulga National Park, 0.5 km NNE of Tarra Valley Picnic Area, 38° 26′ 40″, 146° 34′ 18″, G. Milledge, 5 March–7 May 1996, *Nothofagus cunninghami* forest, intercept trap, 1 male, NMV K-6327; Beech Forest. J. Clark, 11 January 1932, 1 male, NMV; Otway Ranges, Maits Rest, 10 km W of Apollo Bay, -38° 45′ 0″ S, 143° 34′ 0″ E, G. Milledge, 20 February 1992, *Nothofagus cunninghami* forest, direct search, NMV; Central Highlands, the Big Culvert, 2.5 km ENE of Mt. Observation, 37° 33′ 36″ S, 145° 52′ 15′ E, G. Milledge, 19 February 1996, *Nothofagus cunninghami* forest, direct search, 2 females, NMV K-6323; along Carisbrook Creek, approx. 6 miles inland, 19 January 1974, 1 female, NMV; Lind National Park, Olive Creek, A. Neboiss, 18 December 1976, 1 male, NMV; Falls Creek Ski Village, A. Neboiss, 26 January 1957, 1 male, 1 female, NMV; Lock Creek, 9 km W of Buldah, 37° 13′ 60″ S, 149° 3′ 0″ E, ANZSES Expedition, 9 January 1982. 1 male, NMV.

Nanometa sarasini (Berland, 1924), comb. nov.

Figures 14–16, 37

Orsinome sarasini Berland, 1924: 210, figs. 108–112.

Orsinome sarasini Álvarez-Padilla and Hormiga, 2011: 805, figs. 91D, 96A–G, 97A–H, 98A–F, 99A–F.

TYPE MATERIAL: Two female and four male syntypes from New Caledonia, Forêt du Mont Ignambi, au-dessus d'Oubatche, 800–1000 m. May 1911. We have not been able to locate the syntypes; other Berland types from that publication are deposited at the MNHN and Naturhistorisches Museum, Basel, Switzerland. Nonetheless, the drawings and description quality are enough to make accurate identifications.

DIAGNOSIS: The long male pedipalpal tibia with about 10 trichobothria is unique for this species (fig. 16A–C). Additionally, *N. sarasini* can be differentiated from other large *Nanometa* species by the following combination of characters: epigynum rectangular at least three times wider than long, genital openings visible on ventral view and located at the sides of the epigynum, septum wide, at least three times its length (figs. 14B–D, 16D), spermathecae longer than wide, L-shaped, walls well sclerotized, copulatory "sacs" cuticle translucent and weakly sclerotized (figs. 14F, 16E). CEBP apophysis large, excavated at its base and continuous with the CEMP (figs. 15D, 16B). CEMP tip separated from the cymbium and L-shaped (fig. 16A–C).

DESCRIPTION: Female (TEAU011) total length 8.9. Cephalothorax length 3.6, width 2.7. Clypeus height 1.1 AME diameter. Cephalothorax background dark yellow, cephalic region and carapace margins dark brown (fig. 14A, C). Eyes subequal in size, lateral smaller. Sternum dark brown (fig. 14E). Cheliceral promargin and retromargin each with three teeth, ca. three cheliceral denticles. Abdomen dorsum background gray, ca. six to five pairs of guanine patches concentrated in the center and delineated by dark-brown patches (fig. 14A). Stridulatory organ present in females as a cuticular thick and highly sclerotized ridge on booklung anterior edge (fig. 14H). Lateral line of guanine patches diffuse and intercalated with dark-brown reticulated spots (fig. 14C). Femur I length 6.9. Copulatory ducts modified as membranous sacs with translucent cuticle and internal sclerotized apodemes, spermathecae longer than wide (figs. 14F, 16E), accessory duct glands not examined with SEM.

Male (TEAU012) same as female except as noted. Total length 6.9. Cephalothorax length 3.1, width 2.5. Clypeus 2.0 AME diameter (fig. 14I). Cephalothorax and abdomen lighter than in female. Cheliceral promargin and retromargin with three and one teeth respectively, denticles ca. 10. Stridulatory organ slightly longer, coxa IV retrolateral not examined with SEM. Femur I length 7.5. Conductor tip apophyses present (figs. 15A, F, H, I, 16A–C).

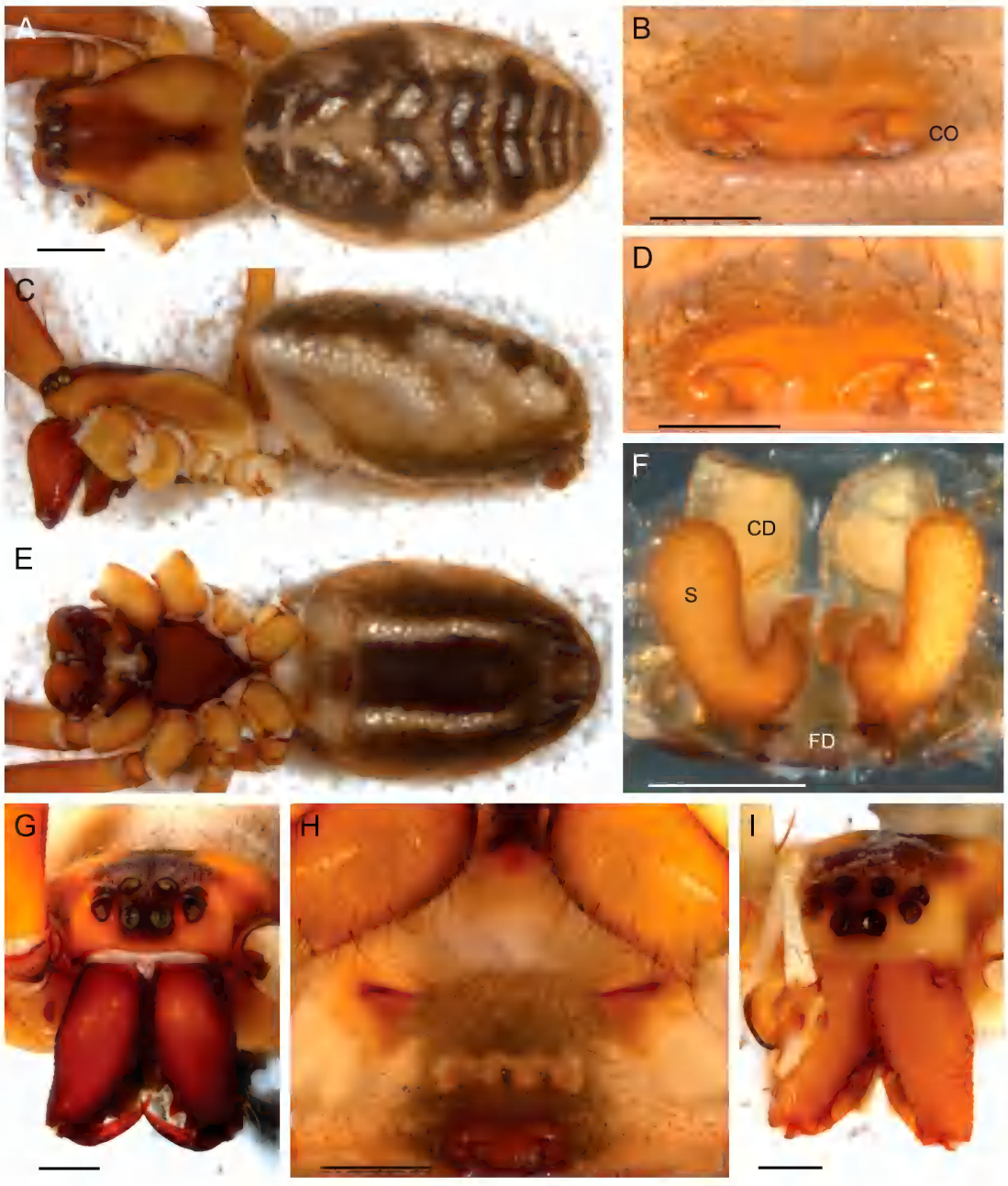

FIGURE 14. *Nanometa sarasini* (male: TEAU012; female: TEAU011). **A.** Female, dorsal habitus. **B.** Epigynum, ventral. **C.** Female, lateral habitus. **D.** Epigynum, caudal. **E.** Female, ventral habitus. **F.** Epigynum, dorsal digested. **G.** Female, frontal habitus. **H.** Stridulatory ridge. **I.** Male, frontal habitus. Scale bars: A, C, E, 1.0 mm; B, D, F, 0.2 mm; G–I, 0.5 mm.

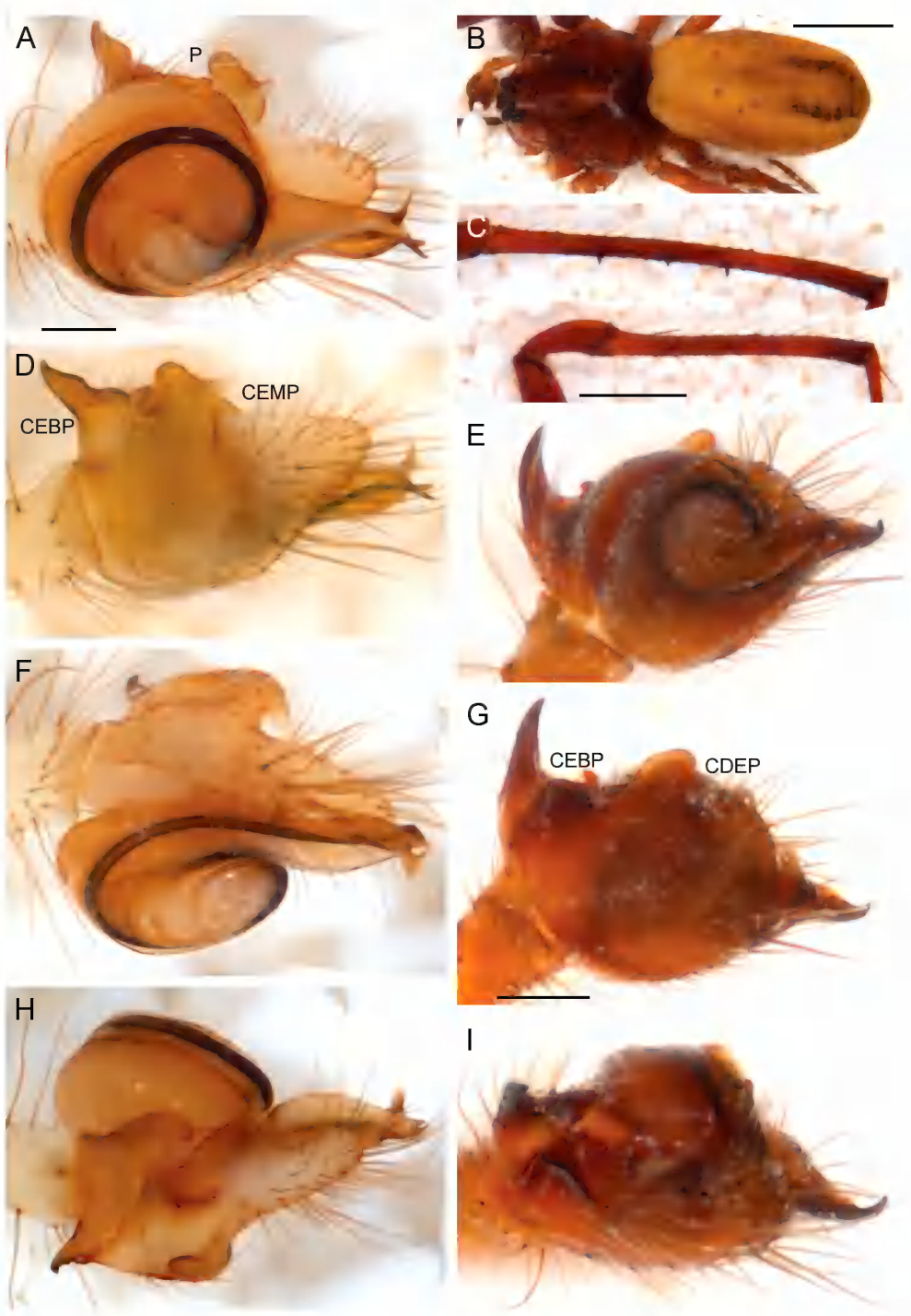

FIGURE 15. *Nanometa sarasini* (TEAU012; **A, C, E, G**), and *N. fea* (TEAU013; **B, D, F, H**). **A.** Pedipalp, ventral. **B.** Male, dorsal habitus. **C.** Male tibiae I and II. **D.** Pedipalp, dorsal. **E.** Pedipalp, ventral. **F.** Pedipalp, mesal. **G.** Pedipalp, dorsal. **H.** Pedipalp, ectal. **I.** Pedipalp, ectal. Scale bars: A–I, 0.2 mm; B, C, 1.0 mm.

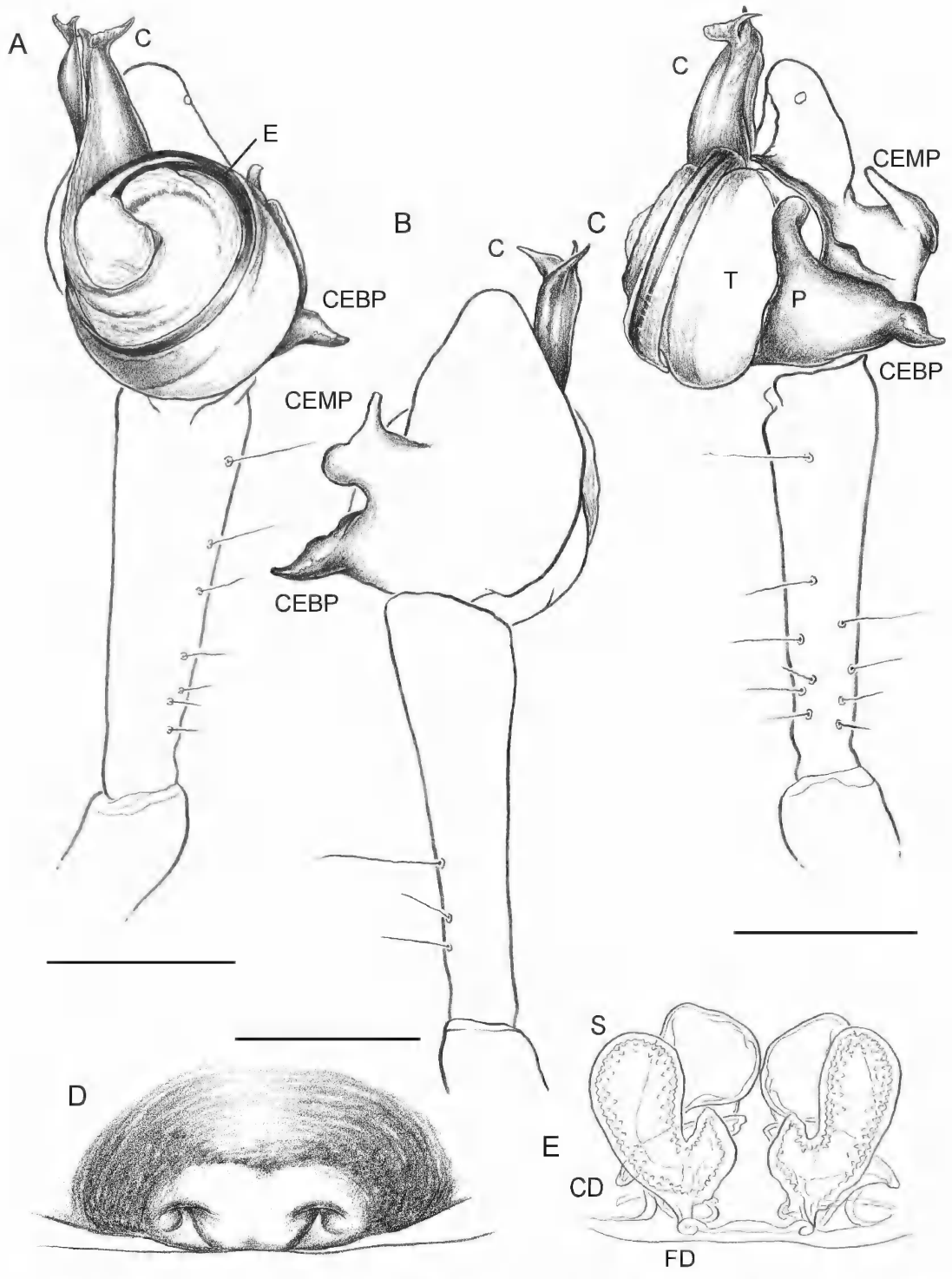

FIGURE 16. *Nanometa sarasini* (QM S25460). **A.** Pedipalp, ventral. **B.** Pedipalp, dorsal. **C.** Pedipalp, ectal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–D, 0.5 mm; E, 0.2 mm.

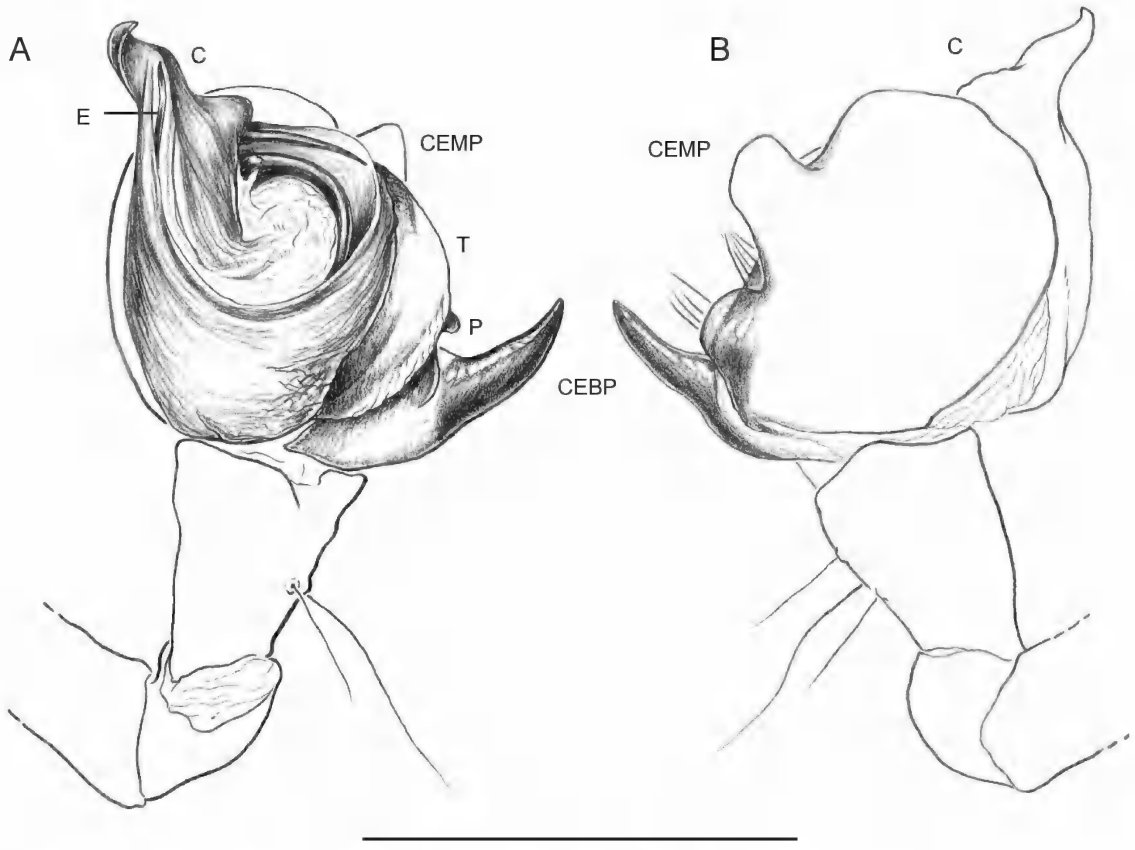

FIGURE 17. *Nanometa fea*, pedipalp (TEAU013). **A.** Ventral. **B.** Dorsal. Scale bars: 0.5 mm.

DISTRIBUTION: This is the only nanometine collected in New Caledonia (fig. 37C).

MATERIAL EXAMINED: $N = 8$. NEW CALEDONIA, Mt. Panié, 20° 35′ 0″ S, 164° 45′ 0″ E, 1300 m. R.J. Raven 4–14 December 1990, *Agathis montana* rainforest, QM S25460 (one female specimen removed for image voucher TEAU011); Mt. Panié, 20° 35′ 0″ S, 164° 45′ 0″ E, 1300 m. R.J. Raven 4–14 December 1990, *Agathis montana* rainforest, QM S25460 (one male specimen removed for image voucher TEAU012); Mt. Panié, 20° 35′ 0″ S, 164° 45′ 0″ E, 1300 m. R.J. Raven 4–14 December 1990, *Agathis montana* rainforest, 3 males, 2 females QM S25460. Mt. Panié, 20° 35′ 0″ S, 164° 45′ 0″ E, 1300 m. R.J. Raven, T. Churchill, 2–3 November 1988, night collecting, 1 male, QM S34217.

***Nanometa fea*, sp. nov.**

Figures 15, 17, 37

TYPE MATERIAL: Male holotype from Papua New Guinea, Morobe Prov. Mt. Kaindi, 7° 20′ 22.59″ S, 146° 40′ 41.69″ E, 2360 m. W. Shear, 17 November 1980, Moss Forest (AMNH).

DIAGNOSIS: Specimens of *N. fea* can be differentiated from other large *Nanometa* species by the following combination of characters: tibia I ventral surface with small and thick macrosetae (fig. 15C), CEBP with only one large sclerotized apophysis, CEMP a triangular cuticular projection, tip separated from the CEMP and located on the cymbium retrolateral edge (figs. 15G, 17A, B). Conductor tip hook shaped and heavily sclerotized (figs. 15E, G, I, 17A).

DESCRIPTION: Male (holotype, TEAU013) total length 4.1. Cephalothorax length 1.9, width 1.5. Clypeus height 1.6 AME diameter. Cuticle coloration dark brown (probably due to preservation artifacts) (fig. 15B). Eyes subequal in size, lateral smaller. Sternum dark brown. Cheliceral promargin and retromargin teeth not observed due to state of specimen preservation. Abdomen dorsum background dark yellow, without guanine patches and a posterior black band (fig. 15B). Stridulatory organ along the anterior booklung edge, coxa IV not observed with SEM. Male pedipalp as described in the diagnosis.

ETYMOLOGY: The species epithet is taken from the feminine Spanish word for ugly, *fea*, and it refers to the poor preservation state of the only known specimen.

DISTRIBUTION: Papua New Guinea (fig. 37C).

MATERIAL EXAMINED: No additional material examined.

Nanometa tetracaena, sp. nov.

Figures 18–19, 37

TYPE MATERIAL: Male holotype and female allotype from Australia, Victoria, Strzelecki Ranges, Gunyah-Toora Rd., 2 km SSW of Gunyah, -38.541, 146.317, G. Milledge, 5 March 1995 (NMV K-6309); both types deposited at NMVM.

DIAGNOSIS: Males of *N. tetracaena* are most likely to be confused with *N. dutrorum*. The CEMP of *N. tetracaena* (figs. 18D, 19C) does not bear the conspicuous spine found in *N. dutrorum* (figs. 31C, 33C), its conductor lacks the serrated denticles found in *N. dutrorum* (fig. 33A–C), and the embolic process is more sclerotized than that of *N. dutrorum* (fig. 31A, E). The CEBP of *N. tetracaena* has four apophyses, whereas *N. dutrorum* has three. The epigynum of *N. tetracaena* has a small carina separating the copulatory openings (figs. 18E, 19D), which is readily distinguishable from the shallow, M-shaped ridge on the epigynum of *N. dutrorum*.

DESCRIPTION: Female (NMV K-6295) total length 3.14. Cephalothorax length 1.09, width 0.85. Clypeus height 1.0 AME diameter. Cephalothorax background pale yellow, with light gray concentrated over ocular area, carapace lateral edges, and near margin of pars cephalica and pars thoracica (fig. 18A). Endites and sternum grayish yellow (fig. 18C). Cheliceral promargin and retromargin with three and two teeth, respectively, cheliceral denticles present. Abdomen dorsum background pale brown, silvery guanine patches covering all abdomen dorsal surface, except a medial line that extends the entire abdomen length (fig. 18A), lateral surface covered with guanine patches over dorsal half, ventral half with brown lines (fig. 18A, C), ventral surface brown intercalated with silvery guanine patches and with a central rectangle flanked by two lines (fig. 18C). Booklung stridulatory organ, tracheae and epigynum not observed with SEM. Femur I length 1.7.

Male (NMV K-6305) same as female except as noted. Total length 2.75. Cephalothorax length 1.15 width 0.94. Clypeus 1.5 AME diameter. Cephalothorax and abdomen coloration slightly darker than in female, silvery guanine patches less conspicuous and reduced into longitudinal stripes. Cheliceral promargin and retromargin with three and two teeth respectively. Cheliceral denticles present, stridulatory organ and coxa IV retrolateral surface not observed with SEM. Femur I length 2.6. Palp with conspicuous CEMP and CEBP with four pointed apophyses.

VARIATION: Females ($N = 3$) total length 2.82–3.27, cephalothorax length 1.13–1.27, width 0.84–0.94. Males ($N = 3$) total length 2.41–2.82, cephalothorax length 0.99–1.30, width 0.82–1.08.

ETYMOLOGY: The specific epithet is from the Greek *tetra* (four) and *acaena* (spikes or thorns), referring to the four points on the CEBP.

DISTRIBUTION: *Nanometa tetracaena* can be found in Tasmania, Victoria and southern New South Wales (fig. 37D).

MATERIAL EXAMINED: $N = 88$. AUSTRALIA, Victoria: Central Highlands, Acheron Gap, 6 km NE of Mt. Donna Buang, 37° 41′ 20.4″ S, 145° 44′ 20.4″ E, G. Milledge, 28 December 1995,

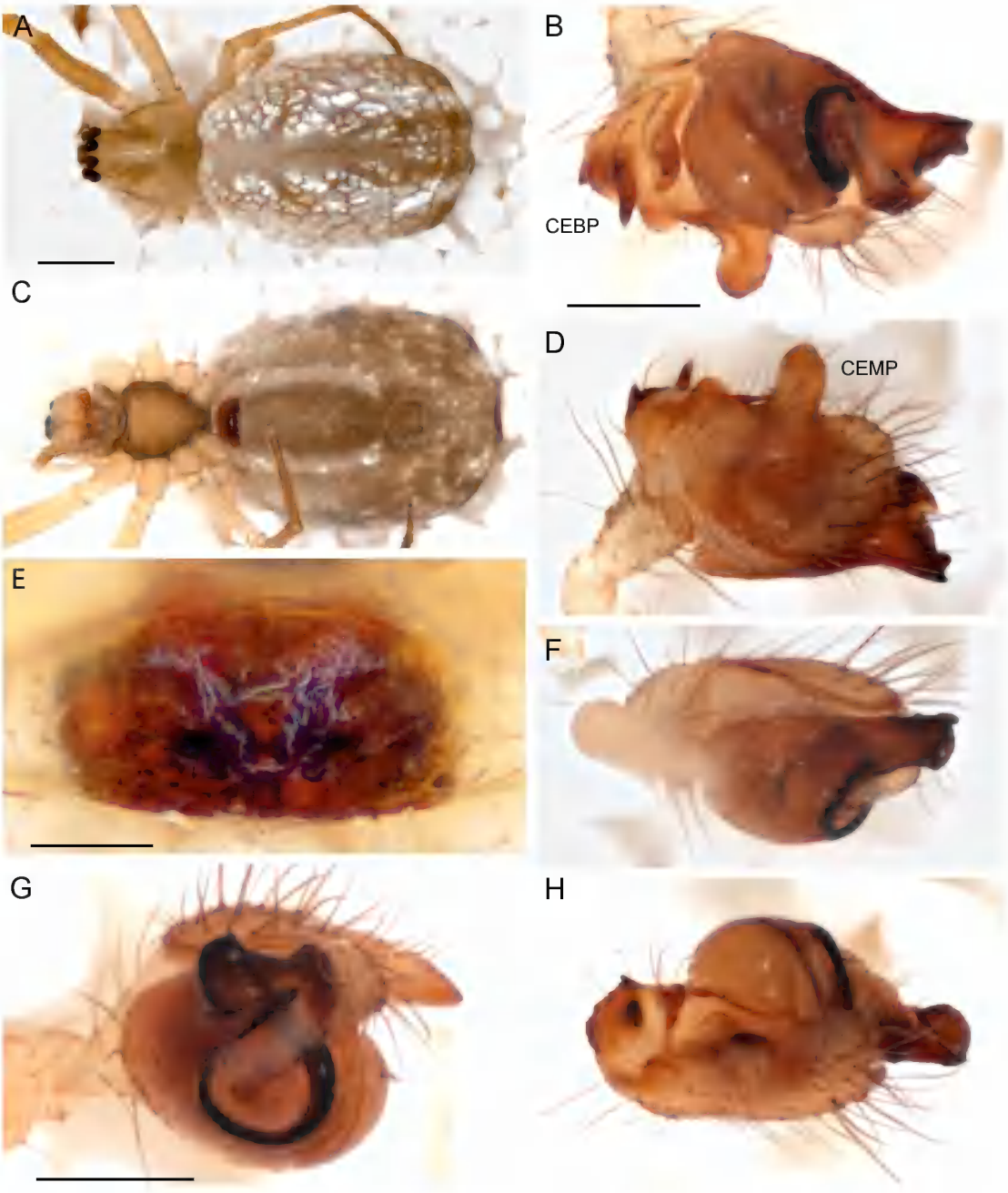

FIGURE 18. *Nanometa tetracaena* (female: NMV K-6295; male: NMV K-6305) **A.** Female, dorsal habitus. **B.** Pedipalp, ventral. **C.** Female, ventral habitus. **D.** Pedipalp, dorsal cleared. **E.** Epigynum, ventral. **F.** Pedipalp, mesal. **G.** Pedipalp, apical. **H.** Pedipalp, ectal. Scale bars: A, C, 0.5; B, D, F–H, 0.2; C, 0.1 mm.

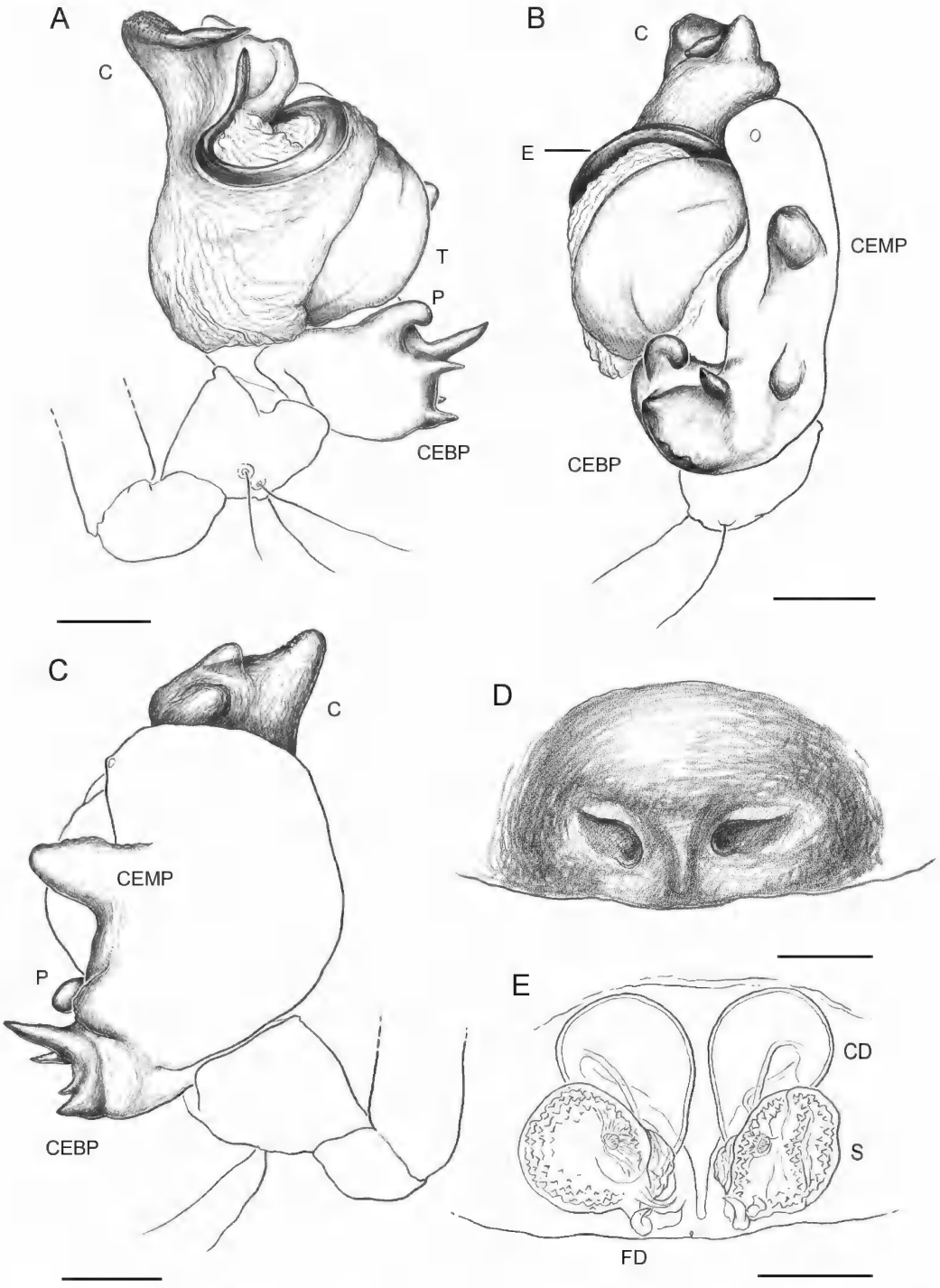

FIGURE 19. *Nanometa tetracaena* (NMV K-6297). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: 0.1 mm.

Nothofagus cunninghami forest, intercept trap, 3 males, 7 females, NMV K-6297; Central Highlands, Acheron Gap, 6 km NE of Mount Donna Buang, 37° 41′ 20.4″ S, 145° 44′ 20.4″ E, G. Milledge, 20 February 1996, direct search, 2 males, NMV K-6317; Central Highlands, Acheron Gap, 6 km NE of Mt. Donna Buang, 37° 41′ 20.4″ S, 145° 44′ 20.4″ E, G. Milledge, 28 December 1995–21 February 1996, direct search, 1 male, 3 females, NMV K-6298. Central Highlands, The Big Culvert, 2.5 km ENE of Mt. Observation, 37° 33′ 36″ S, 145° 52′ 15.6″ E, G. Milledge, 19 February 1996, *Nothofagus cunninghami* forest, direct search, 2 males, 3 females, NMV K-6302; Mount Donna Buang, A. Neboiss, 5 February 1995, 1 male, 1 female, NMV; Great Otway National Park, Triplet Falls track, 38° 40′ 12″ S, 143° 29′ 52.80″ E, G. Hormiga & N. Scharff, 312 m, 16 April 2014, sifted litter, GWU (GH1697); Otway Ranges, Aire Crossing Track, 0.5 km N of Aire R. Crossing, 38° 42′ 0″ S, 143° 28′ 58.8″ E, P. Lillywhite, 31 January 1995, *Nothofagus cunninghami* forest, sweep net, 2 males, 3 females, NMV K-6293; Otway Ranges, Beauchamp Falls, 38° 38′ 60″ S, 143° 35′ 60″ E, G. Milledge, 15 November 1994–31 January 1995, intercept trap, 1 male, 2 females, NMV K-6830; Otway Ranges, Beauchamp Falls, 38° 38′ 60″ S, 143° 35′ 60″ E, G. Milledge, 31 January 1995–11 April 1995, 1 male, 2 females, NMV K-6294; Otway Ranges, Young's Creek Rd, 0.4 km NW of Triplet Falls, 38° 40′ 1.2″ S, 143° 22′ 58.8 E, G. Milledge, 31 January 1995, *Eucalyptus* sp. forest, intercept trap, 3 males, NMV K-6826; Otway Ranges, Young's Creek Rd, .0.4 km NW of Triplet Falls, 38° 40′ 1.2″ S, 143° 22′ 58.8 E, G. Milledge, 31 January 1995, *Eucalyptus* sp. forest, direct search, 3 females, NMV K-6823; Otway Ranges, Young's Creek Rd, .0.4 km NW of Triplet Falls, 38° 40′ 1.2″ S, 143° 22′ 58.8 E, P. Lilywhite, 5 females, NMV K-6295; Phillips Track, Young's Creek crossing, 0.5 km N of Triplet Falls, G. Milledge, 20 February 1992, *Nothofagus cunninghami* forest, direct search, 2 females, 3 males, NMV; Strzelecki Ranges, Gunyah-Toora Rd., 2 km SSW of Gunyah, 38° 32′ 31.2″ S, 146° 19′ 1.2″ E, G. Milledge, 5 March 1995, *Nothofagus cunninghami* forest, intercept trap, 1 male, 1 female, NMV K-6386; Strzelecki Ranges, Gunyah-Toora Rd., 2 km SSW of Gunyah, 38° 32′ 31.2″ S, 146° 19′ 1.2″ E, G. Milledge, 5 March 1995, *Nothofagus cunninghami* forest, intercept trap, 1 male, 1 female, NMV K-6308; Strzelecki Ranges, Gunyah-Toora Rd., 2 km SSW of Gunyah, 38° 32′ 31.2″ S, 146° 19′ 1.2″ E, G. Milledge, 5 March 1995, *Nothofagus cunninghami* forest, intercept trap, 2 males, 12 females, NMV K-6309; Strzelecki Ranges, Gunyah-Toora Rd., 2 km SSW of Gunyah, 38° 32′ 31.2″ S, 146° 19′ 1.2″ E, G. Milledge, 5 March 1995, *Nothofagus cunninghami* forest, intercept trap, 3 males, NMV K-6305; Strzelecki Ranges, Tarra-Bulga National Park, 0.5 km NNE of Tarra Valley Picnic Area, 38° 26′ 38.4″ S. 146° 32′ 31.2″ E, G. Milledge, 10 January 1996–5 March 1996, *Nothofagus cunninghami* forest, intercept trap, 2 females, NMV K-6314. Tasmania: Mt. Michael, rainforest between Mt. Michael and Little Mt. Michael, 41° 10′ 58.8″ S, 148° 0′ 0.0″, R. Coy, P. Lillywhite, & A.L. Yen, 20 February 1990, *Nothofagus cunninghami* forest, 2 males, 3 females, NMV; Pirates Rd., 2.5 km SW of Eaglehawk Neck, 43° 3′ 10.8″ S, 147° 54′ 18″ E, R. Coy, P. Lillywhite, & A.L. Yen, 13 February 1990, *Nothofagus cunninghami* forest, 2 males, 3 females, NMV. New South Wales: Blue Mountains National Park, Mt. Wilson, 33° 29′ 55.75″ S, 150° 24′ 53.063″ E, 955 m, G. Hormiga & N. Scharff, 3 April 2014, 1 male, 1 female (GH1662), GWU; Jamberoo Mountain, 1 January 1993, J. Noble, 1F, KS 54234. Mt. St. Leonard, 37° 33′ 59.76″ S, 145° 31′ 59.88″ E, M.S. Harvey & M.E. Blosfelds, June 4 1991,1 male, WAM T23237; Jamberoo Mountain, 1 January 1993, J. Noble, 1F, KS 54234. Mt. St. Leonard, 37° 33′ 59.76″ S, 145° 31′ 59.88″ E, M.S. Harvey & M.E. Blosfelds, June 4 1991, many females, WAM T23193; Coranderrk Reserve, Healesville, -37.7166, 145.5500, P.J. Gullan, 1 male, WAM T24693. Strathgordon, 42° 46′ 1.2″ S, 146° 3′ 0.0″ E, 6 January 1998, L.J. Boutin, 2MM, 2FF, QVM 13:43581; Mt. Wedge Track, 42° 52′ 58.8″ S, 146° 18′ 0.0″ E, 7 January 1998, L.J. Boutin, 1FF, 1M,

QVM 13: 24035; Maggs Mountain, *Eucalyptus* foliage, 9 December 1975, R.H. Green, 3FF, QVM 13: 44509; Maggs Mountain, 1979, R.H. Green, 1M, KS 52097; Strahan, rainforest nr. Hogarth Falls, 42° 8′ 60″ S, 145° 19′ 1.2″ E, 12 November 1997, L.J. Boutin, sweeping, 4MM, 1F, QVM 13:24059; Edgar Dam Campground, nr. Lake Peddar, 43° 1′ 58.8″ S, 146° 20′ 60″ E, 5 January 1998, L.J. Boutin, from sweeping, 2MM, 2FF, QVM 13:43593; Frenchmans Cap track, 42° 4′ 58.8″ S, 145° 55′ 58.80″ E, 24 December 1997, L.J. Boutin, mixed forest, sweeping, 2FF, 3MM, QVM 13:24066.

Nanometa lagenifera (Urquhart, 1888), comb. nov.

Figures 20, 22–24, 37

Linyphia lagenifera Urquhart, 1888: 111, pl. 11, fig. 4 (female type, not examined).

Tetragnatha herbigrada Urquhart, 1890: 253 (type not examined, depository unknown). Synonymized by Bryant (1933).

Orsinome australis Simon, 1899: 423 (type not examined). Synonymized by Bryant (1933).

Orsinome herbigrada (Urquhart, 1888) Dalmas, 1917: 369, fig. 38.

Orsinome lagenifera (Urquhart, 1888) Bryant, 1933: 21.

Orsiella lagenifera (Urquhart, 1888) Forster and Forster, 1999: 167, figs. 11.30b, 113.30c.

TYPE MATERIAL: Female holotype of *Linyphia lagenifera* from New Zealand, Otago, P. Goyen, deposited at the Canterbury Museum, last revised by Dalmas (1917) and Bryant (1933). Drawings and descriptions by these two authors were accurate for specimen identification.

DIAGNOSIS: Males of *Nanometa lagenifera* differ from those of other congeneric species in New Zealand by its longer embolus, which curves outside the margin of the tegulum in ventral view (fig. 22B), while in *N. purpurapunctata* and *N. forsteri* the embolus is much shorter and curves onto the surface of the tegulum. In ventral view (fig. 24D), females of *N. lagenifera* lack the longitudinal septum of *N. purpurapunctata* and *N. forsteri*. In addition, *N. lagenifera* can be differentiated from other large *Nanometa* species by the following combination of characters: epigynum rectangular flat sclerotized area (fig. 20B), genital openings opening posteriorly, shaped as two sclerotized grooves; median plate hourglass shaped (fig. 20D), genital opening septum narrow, approximately ¼ of the epigynum width (fig. 20B, D). CEBP bearing one small basal apophysis heavily sclerotized (figs. 22B, D, H; 23F, 24A–C). CEMP tip separated from the cymbium and gradually bending as long hook (figs. 22D, 24C). CEMP wider and shorter than in *N. trivittata* and not bent ventrally (figs. 22F, 23F).

DESCRIPTION: Female (TEAU009, TEAU024, TEAU040) total length 8.0. Cephalothorax length 3.0, width 2.4. Clypeus height 1.1 AME diameter. Cephalothorax yellow with dark-brown pattern (fig. 20A, C). Eyes subequal in size, lateral smaller (fig. 20G). Sternum dark brown (fig. 20E). Cheliceral promargin and retromargin with three and two teeth, respectively, ca. five cheliceral denticles. Abdomen dorsum background gray, guanine patches concentrated in the center, delineated by two lines of dark-brown chevrons and guanine patches (fig. 20A). Lateral line of guanine patches diffuse and intercalated with dark-brown reticulated spots (fig. 20C). Tracheae observed with SEM, median tracheael trunks branched, lateral tracheae tube shaped. Femur I length 5.9. Copulatory ducts modified as membranous sacs with translucent cuticle and internal sclerotized apodemes, spermathecae oval, translucent, and weakly sclerotized (figs. 20H, 24E), accessory duct glands clustered on puffball-shaped clusters (figs. 23D, 24E).

Male (TEAU010) as female except as noted. Total length 7.5. Cephalothorax length 2.1, width 2.4. Clypeus 1.2 AME diameter (fig. 20I). Cephalothorax and abdomen lighter than in female. Cheliceral promargin and retromargin with three and two teeth respectively, denticles ca. two. Stridulatory organ formed by a cuticular thick

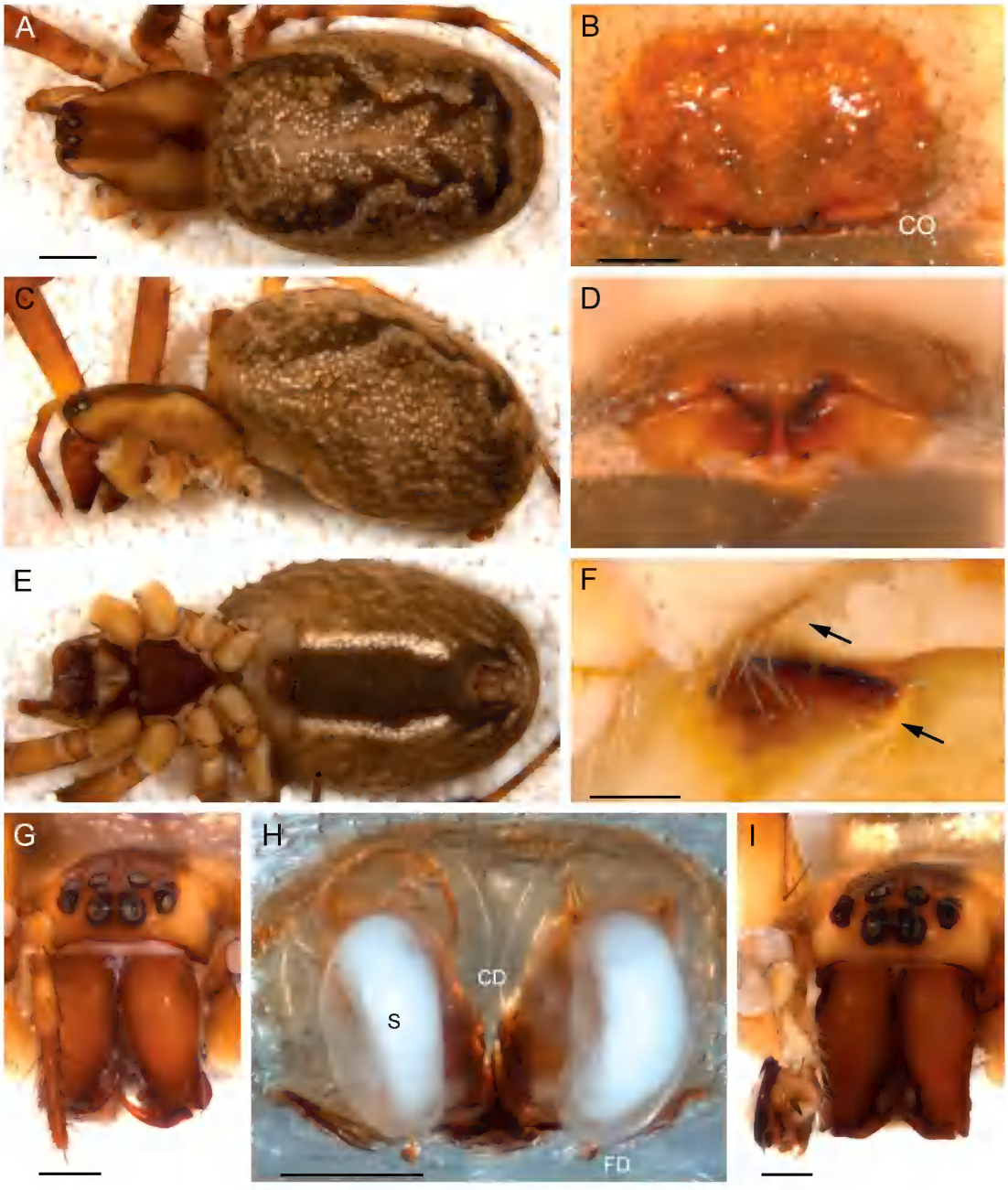

FIGURE 20. *Nanometa lagenifera* (female: TEAU009, TEAU024; male: TEAU010). **A.** Female, dorsal habitus. **B.** Epigynum, ventral. **C.** Female, lateral habitus. **D.** Epigynum, caudal. **E.** Female, ventral habitus. **F.** Stridulatory ridge anterior to booklung cover and sclerotized cuticle of coxa IV indicated with arrows. **G.** Female, frontal habitus. **H.** Epigynum, dorsal digested. **I.** Male, frontal habitus. Scale bars: A, C, E, 1.0 mm; B, D, F, H, 0.2 mm; G, I, 0.5 mm.

and highly sclerotized ridge on the booklung anterior edge, coxa IV retrolateral not examined with SEM. Femur I length 10.2. Basal apophysis of conductor tip absent, distal apophysis short and heavily sclerotized (figs. 22B, F, 24A–C).

VARIATION: Females ($N = 3$) total length 7.0–8.0, cephalothorax length 2.8–3.0, width 2.1–2.4. Males ($N = 2$) total length 7.4–8.0, cephalothorax length 2.1–3.3, width 2.4–2.5.

DISTRIBUTION: This species can be found inhabiting the North and South islands of New Zealand (fig. 37E).

NATURAL HISTORY: Forster and Forster (1999: 167, fig. 11.30a) report that *Nanometa lagenifera* seems to be restricted to shady streams and describe their webs as "horizontal snares above the water surface, often anchored to stones or debris sticking out of the water."

REMARKS: Although *Tetragnatha arborea* Urquhart, 1891, is listed as a synonym of *Orsinome lagenifera* in the World Spider Catalog (2019), this species belongs to a different genus and is described below.

MATERIAL EXAMINED: $N = 23$. NEW ZEALAND, South Island: Christchurch City Co., Banks Peninsula, Hinewai Reserve, Big Kanuka Trail. 43° 48′ 38″ S, 173° 1′ 15.6″ E, 508 m. G. Hormiga & N. Scharff, 3 March 2010, sifted leaf litter and mosses, 1 male, 1 female, 4 immatures GWU (measurement voucher FAPM010); Christchurch City Co., Banks Peninsula, Hinewai Reserve, Big Kanuka Trail. 43° 48′ 38″ S, 173° 1′ 15.6″ E, 508 m, G. Hormiga & N. Scharff, 3 March 2010, sifted leaf litter and mosses, 2 males, 1 female GWU (DNA voucher GH11172); Christchurch City Co., Banks Peninsula, Hinewai Reserve, Lower Valley Track, W of Otanerito Homestead, 43° 49′ 38.3″ S, 173° 2′ 40.1″ E, 71 m, G. Hormiga & N. Scharff, 3 March 2010, general collecting at night, 1 female GWU (image voucher TEAU009); Christchurch City Co., Banks Peninsula, Hinewai Reserve, Lower Valley Track, W of Otanerito Homestead, 43° 49′ 38.3″ S, 173° 2′ 40.1″ E, 71 m, G. Hormiga & N. Scharff, 3 March 2010, general collecting at night, 1 male GWU (image voucher TEAU010); Christchurch City Co., Banks Peninsula, Hinewai Reserve, Lower Valley Track, W of Otanerito Homestead, 43° 49′ 38.3″ S, 173° 2′ 40.1″ E, 71 m, G. Hormiga & N. Scharff, 3 March 2010, general collecting at night, 2 males, 4 females, 1 immature GWU (one female SEM voucher TEAU040 all adults paratypes); Christchurch City Co., Banks Peninsula, Hinewai Reserve, Lower Valley Track, W of Otanerito Homestead, 43° 49′ 38.3″ S, 173° 2′ 40.1″ E, 71 m, G. Hormiga & N. Scharff, 3 March 2010, general collecting at night, 1 male, 1 female, 3 immatures, GWU. North Island: Tararua Forest Park, Holdsworth Loop Trail, 40° 53′ 59.9″ S, 175° 27′ 56.5″ E, 338 m. G. Hormiga & N. Scharff, 14–15 April 2011, GWU (DNA voucher GH1113). 1 female GWU (image voucher TEAU024). 4 females, 12 immatures GWU; Waiorongomai Valley, Te Aroha, 37° 33′ 39.25″ S, 175° 45′ 27.81″ E, 72 m. D.J. Vulley, 15 May 1984, one male, one female QM S58329; Franz Josef Glacier, Alex Knob Track, -43.41082804: 170.17762, 182 m, G. Hormiga, G. Giribet, M. Arnedo, R. Fernández, F. Álvarez-Padilla, R.J. Kallal, C. Baker, 17.i.2016, 2 males GWU. Kelceys Bush Conservation Area, 44° 42′ 2.62″ S, 170° 57′ 57.84″ E, 151 m, G. Hormiga, G. Giribet, M. Arnedo, R. Fernández, F. Álvarez-Padilla, R.J. Kallal, C. Baker, 22 January 2016, 9 females, 3 juveniles GWU.

***Nanometa tasmaniensis*, sp. nov.**

Figures 1, 21–23, 25, 37

"*Orsinome*" *sarasini* Álvarez-Padilla and Hormiga, 2011: 805, figs. 91D, 96A–G, 97A–H. 98A–F, 99A–F. (Misidentification, these specimens belong to *Nanometa tasmaniensis*).

TYPE MATERIAL: Female holotype and male allotype from Australia, Tasmania, Cradle Mountain, Lake St. Clair National Park, near Waldheim cabins, 22.6 km 202° SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m. G. Hormiga, L. Lopardo 3–5 March 2006, *Nothofagus forest* (MCZ).

DIAGNOSIS: Males of *N. tasmaniensis* can be diagnosed from other Australian species by the longer embolus, which curves outside the margin of the tegulum in ventral view (fig. 22A), combined with a long, heavy sclerotized and conical CEBP (fig. 22C). The distinctive lateral epigynal lobes are unique to this species (figs. 21B, 25D). In addition, *N. tasmaniensis* can be differentiated from other large *Nanometa* species by the following combination of characters: female genital openings n-shaped ca. 1/3 width of epigynum, septum narrow ca. 1/3 width of the genital opening, median plate triangular (figs. 21B, D, 23A arrow, 25D). Spermathecae spherical, cuticle weakly scolerotized, copulatory "sacs" cuticle translucent (figs. 21F, 23C, 25E). CEBP apophysis armed with three large spines of decreasing length toward the cymbium middle section (figs. 22C, 23E, 25C). CEMP flat cuticular ridge, tip blunt, separated from the cymbium and curved proximally (fig. 22E).

DESCRIPTION: Female (TEAU001, TEAU027, TEAU039) total length 8.1. Cephalothorax length 3.5, width 2.6. Clypeus height 1.6 AME diameter. Cephalothorax background yellow, dark-brown pattern reticulated (fig. 21A). Eyes subequal in size, lateral smaller (fig. 21G). Sternum color dark brown (fig. 21E). Chelicera promargin and retromargin with three and two teeth respectively, ca. five cheliceral denticles. Abdomen roughly spherical, dorsum background gray, guanine patches concentrated in the anterior surface and fewer than in other species, dark-brown spots sparsely distributed (fig. 21A). Lateral line of guanine patches C-shaped and intercalated with dark-brown reticulated spots (fig. 21C). Venter without the central dark longitudinal rectangle (fig. 21E). Tracheae observed with SEM, median tracheae main body leaf shaped, tips slightly ramified; lateral tracheae tube shaped. ALS with one major ampullate, one nubbin, ca. 70 piriform, tartipores present. PMS one minor ampullate, one nubbin, and one cylindrical and three central aciniform. PLS araneoid tripled spigots separated, ca. 14 aciniform spigots distributed in two parallel rows, two cylindrical gland spigots at the periphery. Femur I length 4.4. Copulatory ducts modified as membranous sacs with smooth cuticle, spermathecae round and more sclerotized than "copulatory sacs," accessory duct glands clustered on puffball-shaped clusters (figs. 21F, 23C, 25E).

Male (TEAU002, TEAU007, TEAU027) same as female except as noted. Total length 5.6. Cephalothorax length 2.6, width 2.2. Clypeus 1.6 AME diameter (figs. 21I). Cephalothorax and abdomen coloration lighter than in female, abdomen cylindrical. Cheliceral promargin and retromargin with three and two teeth respectively, denticles ca. two. Stridulatory organ formed by a cuticular sclerotized ridge on booklung plate anterior edge and half its diameter, coxa IV retrolateral surface cuticle covered with scales. Femur I length 5.7. Conductor tip with two apophyses, basal apophysis curved, slender, and almost the same length of the distal apophysis, distal apophysis long and heavily sclerotized (figs. 22A, 23GH, 25A–C). Right pedipalp expanded: basal hematodocha largely distended and responsible for most of the movements, embolic division considerably less expansible. Conductor membranous section partially expanded. Embolus-tegulum membrane turned clockwise only (figs. 22A, 25A).

VARIATION: Females ($N = 5$) total length 6.2–8.3, cephalothorax length 2.8–3.5, width 2.0–2.6. Males ($N = 6$) total length 5.5–6.8, cephalothorax length 2.6–3.1, width 2.0–2.3.

ETYMOLOGY: The species epithet is taken from the island of Tasmania.

DISTRIBUTION: This species is endemic to Tasmania (fig. 37D).

NATURAL HISTORY: *Nanometa tasmaniensis* builds vertical orb webs in shaded, wet areas (figs. 1–2). At nighttime the spider can be found at the hub of the web with the typical resting posture (fig. 1A, C); in daytime it is hidden above the web. Juvenile webs are less densely woven, with fewer radii and spiral turns (fig. 2B).

REMARKS: This species was misidentified by Álvarez-Padilla and Hormiga (2011) as *Orsinome sarasini* in that work.

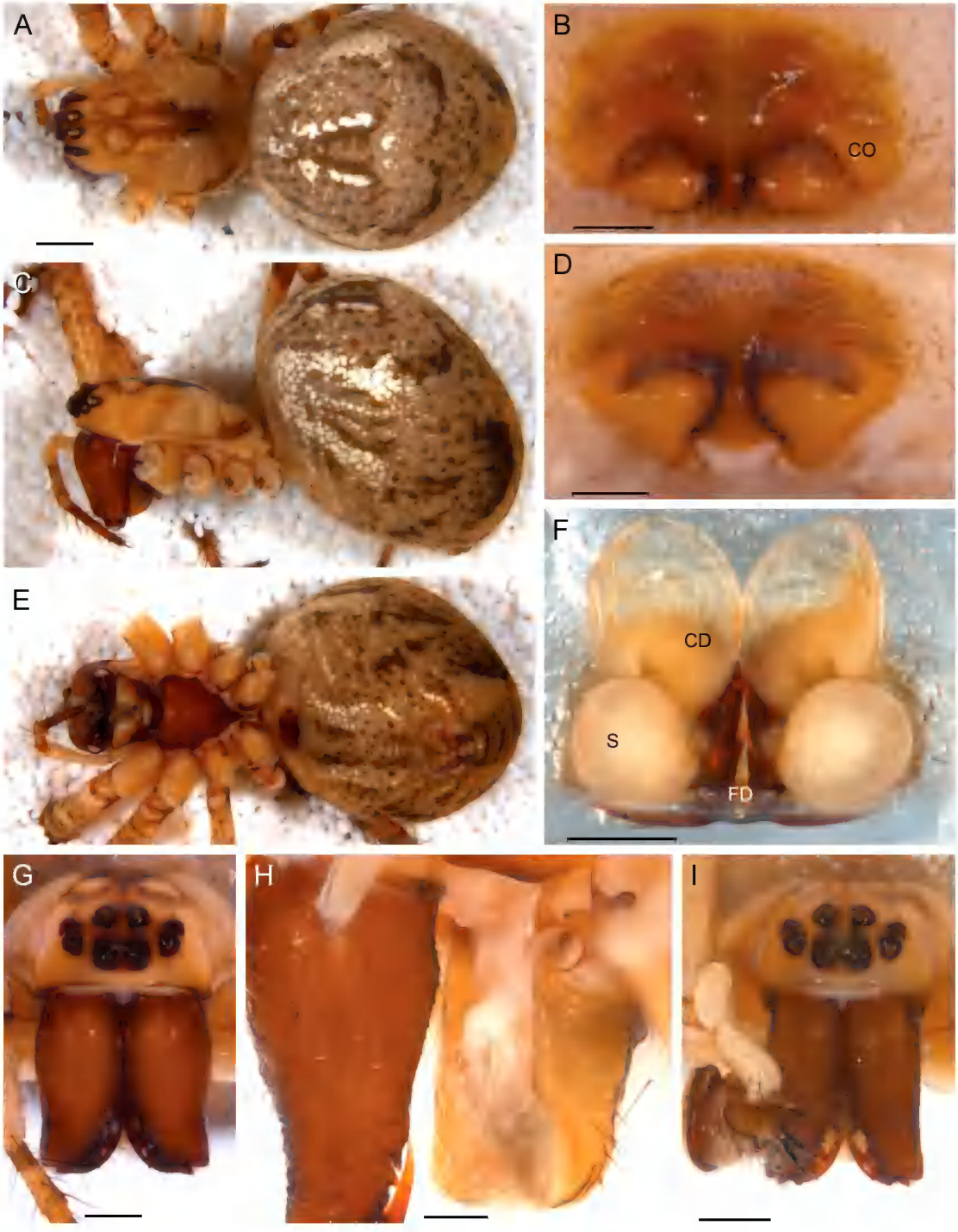

FIGURE 21. *Nanometa tasmaniensis* (female: TEAU001, TEAU027; male: TEAU002). **A.** Female, dorsal habitus. **B.** Epigynum, ventral. **C.** Female, lateral habitus. **D.** Epigynum, caudal. **E.** Female, ventral habitus. **F.** Epigynum, dorsal digested. **G.** Female, frontal habitus. **H.** Male, chelicera and endites. **I.** Male, frontal habitus. Scale bars: A, C, E, 1.0 mm; B, D, F, H, 0.2 mm; G, I, 0.5 mm.

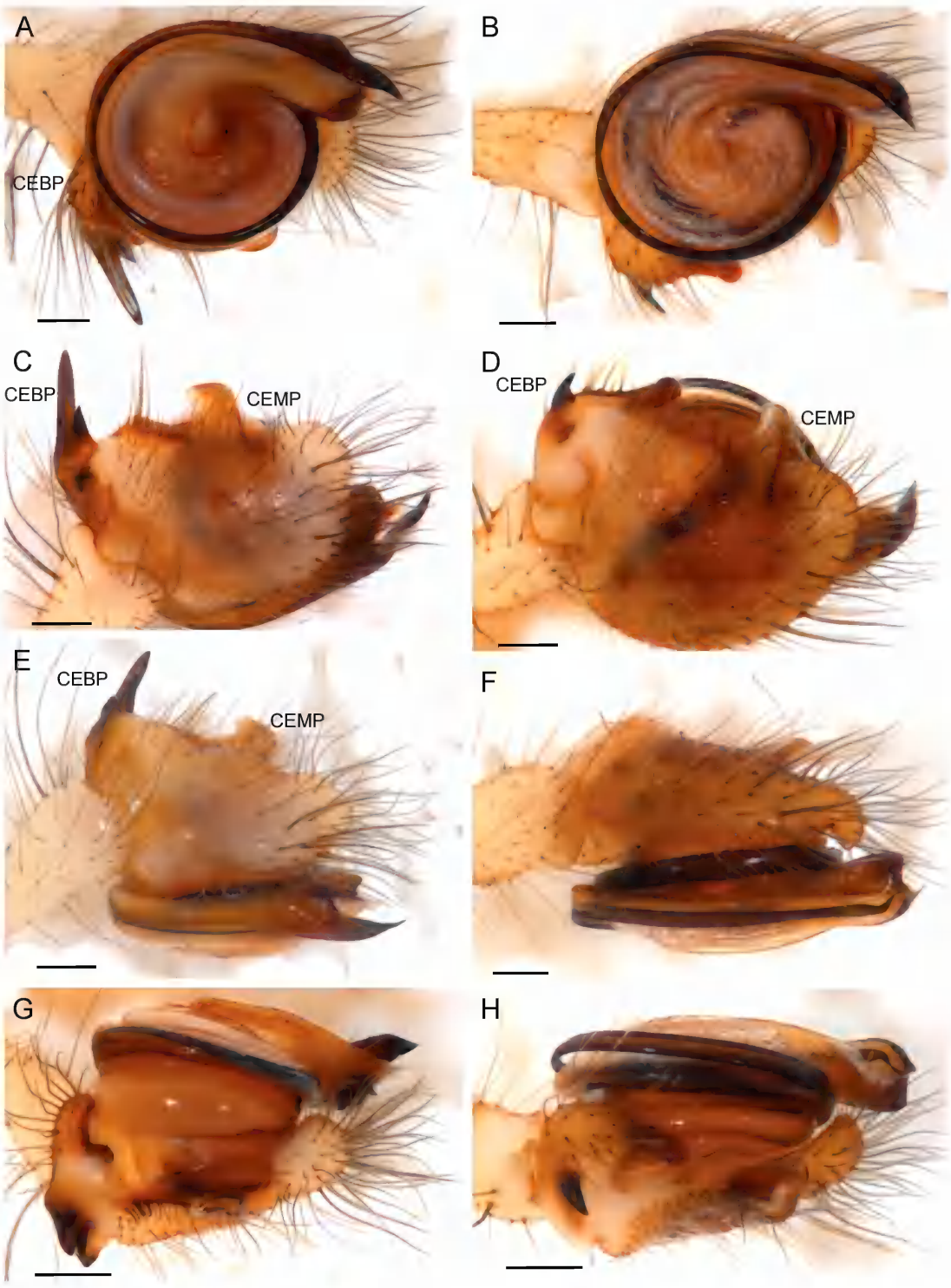

FIGURE 22. *Nanometa tasmaniensis* (**A, C, E, G**), and *N. lagenifera* (**B, D, F, H**), pedipalps. **A, B.** Ventral. **C, D.** Dorsal. **E, F.** Mesal. **G, H.** Ectal. Scale bars: 0.2 mm.

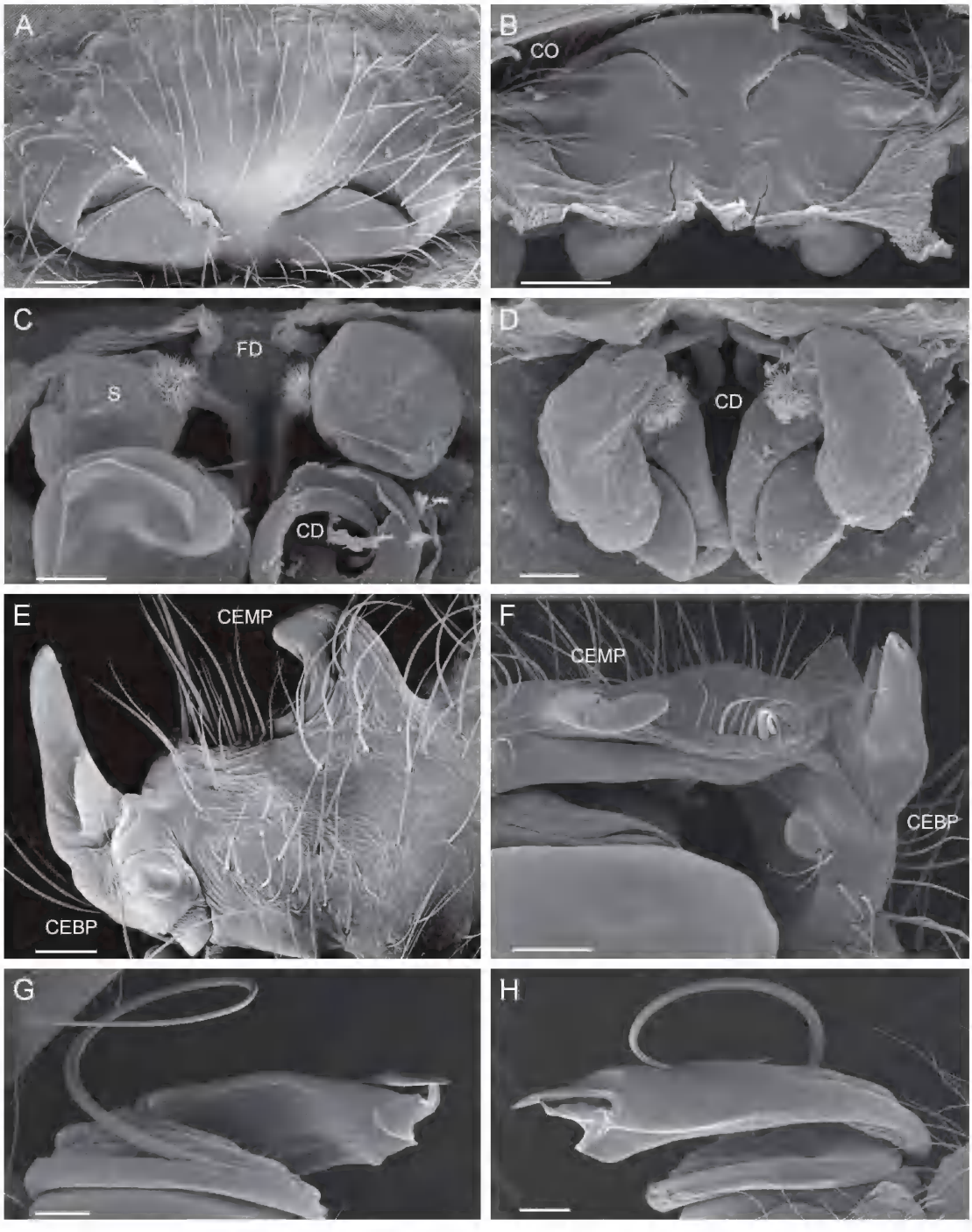

FIGURE 23. *Nanometa tasmaniensis* (**A, C, E–H**), and *N. lagenifera* (**B, D**). **A.** Epigynum, ventral with arrow indicating genital opening. **B.** Female, epigynum, ventral. **C.** Epigynum, dorsal. **D.** Epigynum, dorsal. **E.** Pedipalp, dorsal. **F.** Pedipalp, ectal. **G.** Conductor, ectal detail. **H.** Conductor, mesal detail. Scale bars: 0.1 mm.

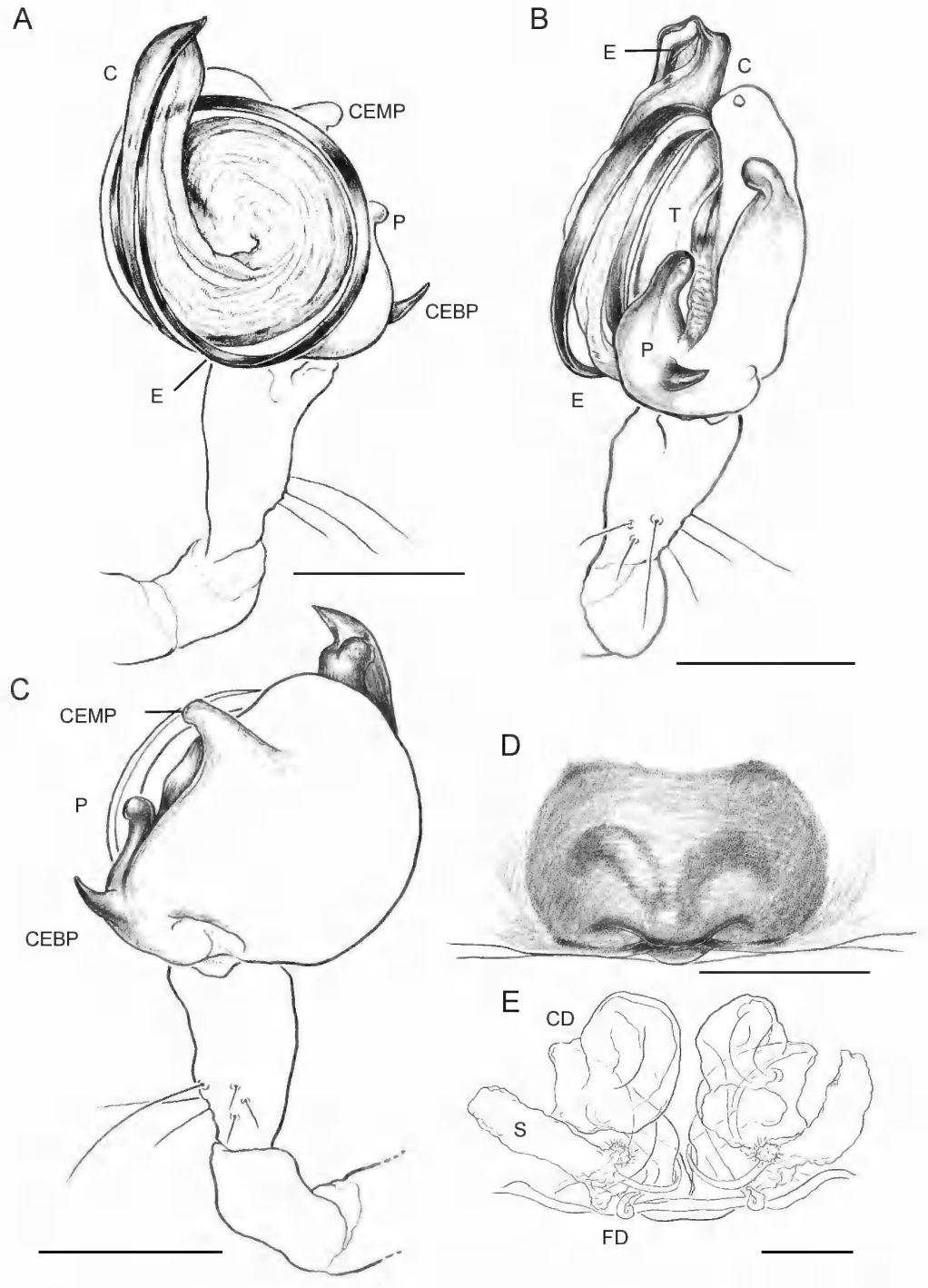

FIGURE 24. *Nanometa lagenifera* (male: TEAU010; female: TEAU009, TEAU024). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–D, 0.5 mm; E, 0.1 mm.

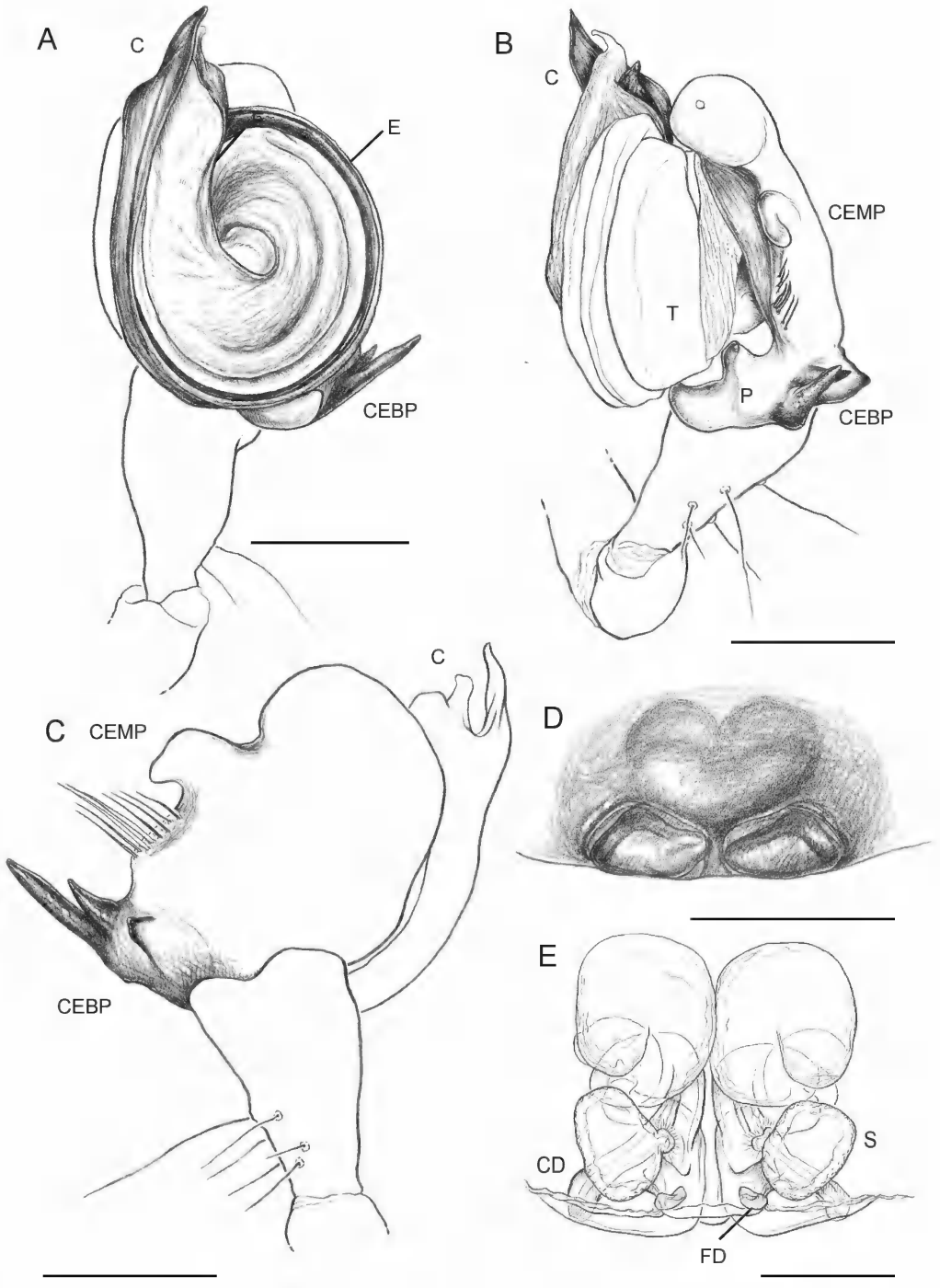

FIGURE 25. *Nanometa tasmaniensis* (TEAU007). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–D, 0.5 mm; E, 0.2 mm.

MATERIAL EXAMINED: $N = 278$. AUSTRALIA: Tasmania, 10 km W Strathgordon, just north of Mt. Sprent, 42° 45′ 55.47″ S, 145° 58′ 12.41″ E, 290 m. N.I. Platnick, R.J. Raven, T.Churchill, 26 April 1987, 1 male, 2 females, 15 immatures AMNH; 5 km S Renison Bell, 41° 50′ 13.54″ S, 145° 24′ 31.13″ E, 180 m, N.I. Platnick, R.J. Raven, T. Churchill, 1 May 1987, pyrethrin fogging of mossy overhang, 2 males, 3 females, 12 immatures AMNH; 8 km SW of Waratah, 41° 29′ 0″ S, 145° 27′ 0″ E, 680 m. Bob Mesibov, 21 September 1990, grid reference CQ702064, 4 males, 3 females QVM 13:44510; 8 km SW of Waratah, 41° 29′ 0″ S, 145° 27′ 0″ E, 680 m. Bob Mesibov, 24 September 1990, CQ703065, QVM 13:44512; Mt. Wellington, nr. Hobart, 42° 53′ 43.5″ S, 147° 14′ 20.77″ E, 1231 m, N.I. Platnick, R.J. Raven, T. Churchill, 4 May 1987, pyrethrin knockdown, 1 male, 1 female, 1 immature, AMNH; Scotts Peak Dam Road, 15 km S Strathgordon Rd, just S Mt. Anne Track, 42° 59′ 0″ S, 146° 20′ 0″ E, 300 m, N.I. Platnick, R.J. Raven, & T. Churchill, 26 April 1987, *Nothofagus* wet rainforest, 2 females, AMNH; 4 km SE Weldborough, 41° 13′ 10.62″ S, 147° 56′ 25.88″ E, 450 m, A. Newton & M. Thayer, 12–14 February 1980, *Nothofagus*, etc. pyrethrin fogging tree ferns, 1 female, AMNH; 4 km SE Weldborough, 41° 13′ 10.62″ S, 147° 56′ 25.88″ E, 450 m, A. Newton & M. Thayer, 12–14 February 1980, fogging *N. cunninghamii* bark, 1 female, AMNH; 6 km east of Strahan, 42° 9′ 12.2″ S, 145° 24′ 6.9″ E, 247 m, N.I. Platnick, R.J. Raven, & T. Churchill, 30 April 1987, rainforest, pyrethrin fogging king fern, 1 male, AMNH; Betts Vale Mt. Wellington, 42° 53′ 46.08″ S, 147° 14′ 37.54″ E, 924 m, V.V. Hickman, 13 January 1953, 1 male, 2 immatures, AM KS28563; Bubs Hill, just W of Victoria Pass, Berlese, 42° 6′ 46.44″ S, 145° 46′ 14.94″ E, 488 m, N.I. Platnick, R.J. Raven, T. Churchill, 28 April 1987, leaf litter, 1 male, 3 immatures, AMNH; Cradle Mountain Camping Ground, 41° 41′ 32.13″ S, 145° 55′ 47.86″ E, 843 m, H.M. & P.K.D., 15 November 1989, Site 2. Tree 2, Myrtle, 1 female, QM S31813; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, *Nothofagus* forest, GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga, 3–5 March 2006, 1 male, 4 females, 1 immature, GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 1 male, 1 female (measurement voucher FAPM002) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 2 males, 14 females, G. Hormiga & L. Lopardo, 3–5 March 2006 (measurement voucher FAPM003) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 1 female, GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 1 male GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 3 males, 2 females (DNA voucher GH0123) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 1 females, G. Hormiga & L. Lopardo, 3–5 March 2006 (DNA voucher GH0124) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 1 female (G. Hormiga field image photos 0229–0250/3.iii.2006) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 1 female (G. Hormiga field image photos 0302–0308/4.iii.2006) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 1 immature

(G. Hormiga field image photos 0309–0316/4. iii.2006) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 3 males, 14 females (image voucher TEAU039) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 1 female (image voucher TEAU001) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 1 male (image voucher TEAU002) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 1 male, 15 females, 2 immatures, G. Hormiga & L. Lopardo, 3–5 March 2006 (image voucher TEAU007) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 5 males, 5 females, 3 immatures (image voucher TEAU027) GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, G. Hormiga & L. Lopardo, 3–5 March 2006, 2 males, 9 females, 1 immature, GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 1 male, 1 female, GWU; Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 1 female, GWU. Cradle Mountain–Lake St. Clair National Park, near Waldheim cabins, 22.6 km SWS Moina, 41° 38′ 28.5″ S, 145° 56′ 26.5″ E, 926 m, 1 male, GWU; Donaghy's Hill, 35 km W Derwent Bridge, 42° 6′ 59.57″ S, 145° 47′ 18.36″ E, 480 m, N.I. Platnick, R.J. Raven, & T.Churchill, 29 April 1987, tree ferns pyrethrin fogging at night, 3 females, 3 immatures, AMNH; Florentine Valley, Punishment Pot cave (JF 373), 42° 34′ 55.35″ S, 146° 28′ 41.6″ E, 419 m, S. Eberhard, 1988, Twilight threshold, 1 female, AM KS20172; Florentine Vy, 29.2 km WNW Maydena, on Eleven Rd., 42° 35′ 26″ S, 146° 25′ 16.85″ E, 460 m, A. Newton & M. Thayer, 6 February 1980, pyrethrin fogging of *Nothofagus cunninghamii,* 1 female, 2 immatures, AMNH; Franklin R. Picnic ground 42° 19′ 0″ S, 145° 47′ 0″ E, 182 m, TC, RR, 29 April 1987, 3 females, 2 immatures, QM S44033; Ida Bay Caves IB 12A, 43° 27′ 45.42″ S, 146° 50′ 27.27″ E, 222 m, D. Rowe, 26 December 1989, 1 female, AM KS32018; Jacks track, 41° 19′ 3.93″ S, 146° 5′ 17.95″ E, 302 m, T. Churchill, 27 April 1987, night collecting, 1 female QM S33814; Kelly Basin, Franklin-Gordon Wild Rivers National Park, 26.4 km SSE Queenstown, 42° 18′ 35.7″ S, 145° 36′ 56.9″ E, 192 m, G. Hormiga & L. Lopardo, 10 March 2006, *Nothofagus* rainforest, 2 males, 13 immatures, GWU; Mount Michael, 41° 10′ 51.96″ S, 148° 0′ 22.65″ E, 778 m, H.M. & P.K.D., 26 November 1989, Tree 2, 1 female, 1 immature, QM S31807; Mount Victoria, 41° 20′ 14.42″ S, 147° 50′ 15.59″ E, 996 m, H.M. & P.K.D., 24 November 1989, Tree 2 hand collecting, 2 males, 3 immatures, QM S31679; Mt. Barrow Rd., 41° 21′ 58.72″ S, 147° 25′ 47.01″ E, 890 m, A. Newton & M. Thayer, 16 February 1980, *Nothofagus cunninghamii* bark pyrethrin spraying, 4 females AMNH. 15–17 February 1980, *Nothofagus*, etc. pyrethrin fogging *Melaleuca* bark, 1 female AMNH; *Nothofagus*, etc. pyrethrin fogging *Eucalyptus* bark, 1 female AMNH; Mt. Field National Park, Lake Dobson Rd., 42° 40′ 30.88″ S, 146° 40′ 59.32″ E, 610 m, A. Newton & M. Thayer, 4 February 1980, *Nothofagus cunninghamii* bark pyrethrin spraying, 1 male, 1 female, 7 immatures AMNH; Mt. Field National Park, Lake Dobson Rd., 42° 40′ 40.54″ S, 146° 42′ 58.68″ E, 240 m, A. Newton & M. Thayer, 30 January–5 February 1980, wet sclerophyll pyrethrin fogging of tree ferns, 1 female AMNH; Mt. Rufus. Tas. Park, 42° 7′ 56.57″ S, 146° 7′ 1.58″ E, 1099 m, TC, RR 29 April 1987, 4 females, 8 immatures, QM S44050; Myrtle Gully Cascades, 42° 53′ 46.91″ S, 147° 16′ 10.34″ E, 249 m, V.V. Hickman 24 February 1945, 1 male, 2 females AM KS28559; Nelson Falls, Franklin-Gordon Wild Rivers

National Park, 15.0 km 89° E Queenstown, 42° 6′ 13.9″ S, 145° 44′ 10″ E, 338 m, G. Hormiga, L. Lopardo, 9 March 2006, *Nothofagus* rainforest, 2 males, 7 females (1 male, 1 female measurement voucher FAPM001) GWU; Nelson Falls, Franklin-Gordon Wild Rivers National Park, 15.0 km 89° E Queenstown, 42° 6′ 13.9″ S, 145° 44′ 10″ E, 338 m, G. Hormiga, L. Lopardo, 9 March 2006, *Nothofagus* rainforest, 11 females, GWU. 7 females, 5 immatures, GWU; Newall Creek, Franklin-Gordon Wild Rivers National Park, 9.57km 177° S Queenstown, 42° 9′ 37.1″ S, 145° 32′ 20.1″ E, 159 m, G. Hormiga, L. Lopardo, 14 March 2006, *Nothofagus* rainforest, 1 male, 5 females, GWU; Newall Creek, Franklin-Gordon Wild Rivers National Park, 9.57km 177° S Queenstown, 42° 9′ 37.1″ S, 145° 32′ 20.1″ E, 159 m, G. Hormiga, L. Lopardo, 14 March 2006, *Nothofagus* rainforest, 2 females, GWU. Cradle Mt. National Park, Waldheim Forest, 41° 23′ 24″ S, 145° 34′ 12″ E, 1000 m, R. Raven, J. Gallon, 31 January–4 February 1987, general and night collection 6 males, 23 females, 47 immatures (1 male, 1 female measurement voucher FAPM004) QM S5546; Cradle Mt. National Park, Waldheim Forest, 41° 23′ 24″ S, 145° 34′ 12″ E, 1000 m, R. Raven, J. Gallon, 31 January–4 February 1987, 1 male, 1 female, 8 immatures QM S5545; Cradle Mt. National Park, Waldheim Forest, 41° 23′ 24″ S, 145° 34′ 12″ E, 1000 m, R. Raven, J. Gallon, 31 January–4 February 1987, 1 male, 5 females, 7 immatures QM S5544; Lake St Clair, 42° 4′ 48″ S, 146° 6′ 0″ E, 700 m, R. Raven, J. Gallon, 29 30 January 1987, heath forest night collecting, 3 females, 2 immatures, QM S5609; Lake edge: under logs and rocks, 3 females, QM S5591; Lake St Clair, Fergies Paddock, 42° 4′ 48″ S, 145° 6′ 0″ E, 700 m, R. Raven, J. Gallon, 25–31 January 1987, heath forest, general collection, 1 female, 1 immature, QM S5654; Punishment Pot JF373 Florentine Valley Twilight Zone, 42° 35′ 5.38″ S, 146° 28′ 44.69″ E, 407 m, R. & S. Eberhard 23 November 1985, 1 male, 2 females, QM S30846; S. Eberhard, 14 September 1984, 1 male QM S30848; Rufus Canal, 13.5 km WNW Derwent Br., 42° 50′ 3.85″ S, 146° 4′ 21.24″ E, 800 m, A. Newton & M. Thayer, 26–28 January 1980, *Nothofagus* rainforest, pyrethrin fogging tree ferns, 1 male, AMNH; Scotts Peak Unnamed cave Cliffline cave site 4, 43° 0′ 17.64″ S, 146° 16′ 25.97″ E, 511 m, A. Clarke, 29 October 1988, 1 male, AM KS21369; St. Columbia Falls, 27.1km 256° W St Helens, 41° 19′ 17.2″ S, 147° 55′ 33.7″ E, 335 m, G. Hormiga, L. Lopardo, 7 March 2006, *Eucalyptus/Casaurina* woodland, 1 male, 8 females, 9 immatures GWU; St. Columbia Falls, 27.1km 256° W St Helens, 41° 19′ 17.2″ S, 147° 55′ 33.7″ E, 335 m, G. Hormiga, L. Lopardo, 7 March 2006, *Eucalyptus/Casaurina* woodland, 1 male, 5 females, GWU; Tasmania, Gordon River, 42° 29′ 37.93″ S, 145° 39′ 52.16″ E, 388 m, C.L. Howard, P.J. Suiter, 10 February 1976, 1 female, 1 immature AM KS27494; N. of Mt. Sprent via Strathgordon, 42° 47′ 24″ S, 145° 57′ 36″ E, 815 m, R. Raven, J. Gallon, 23–25 January 1987, Closed forest total spider collection, 10 females, 18 immatures QM S5710; The Gap, Florentine Rd. 15 km WNW Maydena, 42° 42′ 40.36″ S, 146° 28′ 56.41″ E, 600 m, A. Newton & M. Thayer 1 February 1980, *Nothofagus*, etc. pyrethrin fogging tree ferns, 1 female, AMNH; The Wet Caves Mole Creek (MC-144), 41° 35′ 53.94″ S, 146° 24′ 28.03″ E, 317 m, V.V. Hickman 28 April 1928, 6 females, 1 immature, AM KS28539; Track off Mt. Barrow Rd., 41° 21′ 36.98″ S, 147° 25′ 27.65″ E, 780 m, A. Newton & M. Thayer 15–17 February 1980, *Nothofagus* pyrethrin fogging tree ferns, 1 male, 2 females, 2 immatures AMNH; W. Side Lake St. Clair, 42° 2′ 13.2″ S, 146° 7′ 53.06″ E, 750 m, A. Newton & M. Thayer 25–29 January 1980, *Nothofagus*, etc., pyrethrin fogging tree bark, 1 female AMNH; Weldborough Pass Scenic Reserve, 28.6 km 280° WNW St Helens, 41° 12′ 59.8″ S, 147° 56′ 18.2″ E, 480 m, G. Hormiga, L. Lopardo, 6–7 March 2006, *Nothofagus* forest, 1 female, 1 immature GWU; Weldborough Pass Scenic Reserve, 28.6 km 280° WNW St Helens, 41° 12′ 59.8″ S, 147° 56′ 18.2″ E, 480 m, G. Hormiga, L. Lopardo, 7 March 2006, 2 females GWU; Mt. Michael, rainforest between Mt. Michael and Little Mt. Michael, 41°11′S 148°00′ E, *Nothofagus cunninghamii* sample, R. Coy, P. Lillywhite, and A.L. Yen,

21 February 1990, 1 female NMV; Mt. Field National Park, Lyrebird Track, -42.67944, 146.67, 775 m, G. Hormiga & N. Scharff. 21 April 2014. 3 females, 1 juvenile. GWU. Dove River, below Lake Dove. A. Wells, 18 January 1976. 1 male, 1 female, NMV. Frodshams Pass, Scotts Peak Rd., 1.5 km W of Gordon River Rd., 42° 49′ 0″ S, 146° 22′ 60″ E, R. Coy, P. Lillywhite, & A.L. Yen, 15 February 1990, *Nothofagus cunninghami* forest. 1 male, NMV; Condominion Creek at Scotts Peak Road, A. Neboiss & K. Walker, 9 February 1988, 1 male, NMV; National Park, from *Richea pandanifolia*, 20 January 1964, V.V. Hickman, 2FF, KS 28643.

Nanometa purpurapunctata (Urquhart, 1889), comb. nov.

Figures 26–29, 37

Linyphia purpura-punctata Urquhart, 1889: 134 (syntypes deposited at the Canterbury Museum, not examined).

Linyphia nitidulum Urquhart, 1889: 136 (holotype not examined). Synonymized by Bryant, 1933.

Erycina violacea Urquhart, 1891: 151, pl. 21, figs. 4, 14, 17 (type not examined). Synonymized by Bryant, 1933.

Eryciniolia purpurapunctata (Urquhart, 1889) Strand, 1912: 346. Name preoccupied.

Eryciniola purpurapunctata (Urquhart, 1889) Bryant, 1933: 20, pl. 4, fig. 33, pl. 5, f. 49. Forster and Forster, 1999: 168, fig. 11.31.

Eryciniola purpureopunctata Forster, 1980: 281, fig. 19.

Type material: Female syntype from New Zealand, Wairongomai Gorge, deposited at the Canterbury Museum, revised by Dalmas (1917) and Bryant (1933).

Diagnosis: *Nanometa purpurapunctata* can be differentiated from other *Nanometa* species by its unique eye arrangement: eyes arranged in two lines, AME smaller than the ALE, lateral eyes separated one or more diameters apart (fig. 26G). The eyes of *N. hippai*, *N. lehtineni*, *N. lylei* and *N. padillai* also differ from the norm, but they are arranged in three rows with AME substantially smaller than both PME and PLE, lateral eyes not juxtaposed (fig. 26A, G). The male genital morphology of *N. pupruropunctata* follows the same organization as in the other *Nanometa* species, but it is unique in having a spherical tegulum considerably wider than the conductor-embolus complex (figs. 27A, 29A–C). Other diagnostic features include: CEBP with a small bifurcated spine (figs. 27C, 29A–C), CEMP short and hook shaped. Conductor with an extra apophysis on its median section (fig. 27B).

Description: Female (TEAU025, TEAU044, TEAU049) total length 3.7. Cephalothorax length 1.1, width 1.4. Clypeus height 2.7 AME diameter. Cephalothorax background pale-yellow pattern coloration dark gray (fig. 26A). Eyes in two rows, subequal in size except AME that are smaller (fig. 26G). Sternum pale yellow (fig. 26E). Cheliceral promargin and retromargin with three and one tooth respectively, ca. three cheliceral denticles. Abdomen dorsum background light gray, silvery guanine patches concentrated in the center around two lines of dark-gray spots (fig. 26A), lateral line of guanine patches complete and surrounded with dark-gray reticulated spots (fig. 26C). Booklung stridulatory organ absent. Tracheae observed with SEM, median trunks branched; lateral tracheae tube shaped. Femur I length 4.4. Copulatory ducts short and well sclerotized, spermathecae translucent and weakly sclerotized (figs. 26H, 29E), accessory duct glands opening acorn shaped as in leucaugines and not concentrated in clusters (fig. 28C).

Male (TEAU025, TEAU045) same as female except as noted. Total length 2.7. Cephalothorax length 1.7, width 1.1. Clypeus 2.0 AME diameter (fig. 26I). Cephalothorax and abdomen coloration slightly darker than in female. Cheliceral promargin and retromargin with three teeth and one tooth respectively, denticles ca. two. Stridulatory organ formed by a cuticular ridge highly sclerotized on the booklung

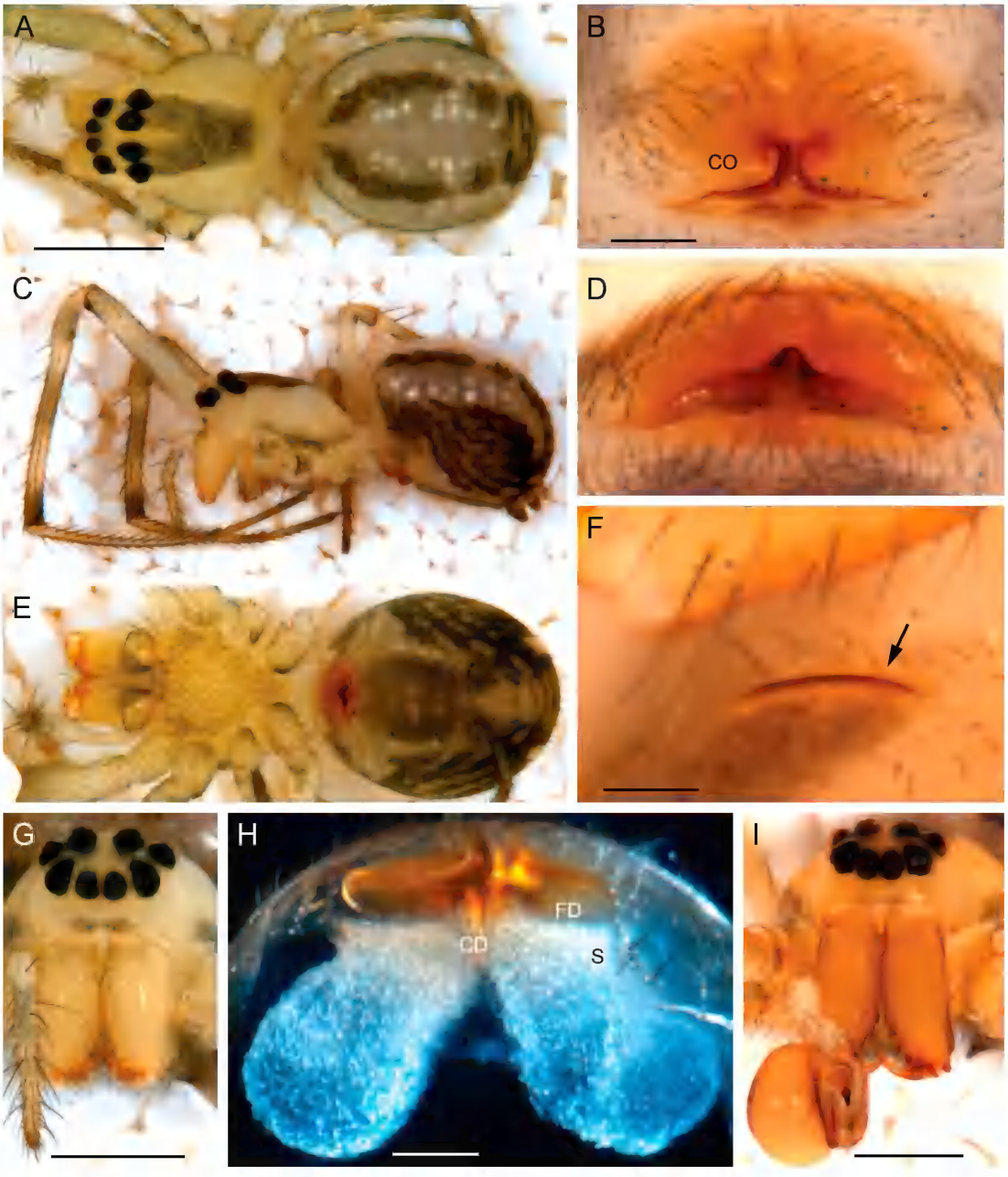

FIGURE 26. *Nanometa purpurapunctata* (TEAU025). **A.** Female, dorsal habitus. **B.** Epigynum ventral. **C.** Female, lateral habitus. **D.** Epigynum, caudal. **E.** Ventral habitus. **F.** Male, stridulatory organ. **G.** Female, frontal habitus. **H.** Epigynum, dorsal digested. **I.** Male, frontal habitus. Scale bars: A, C, E, 1.0 mm; B, D, F, H, 0.1 mm; G, I, 0.5 mm.

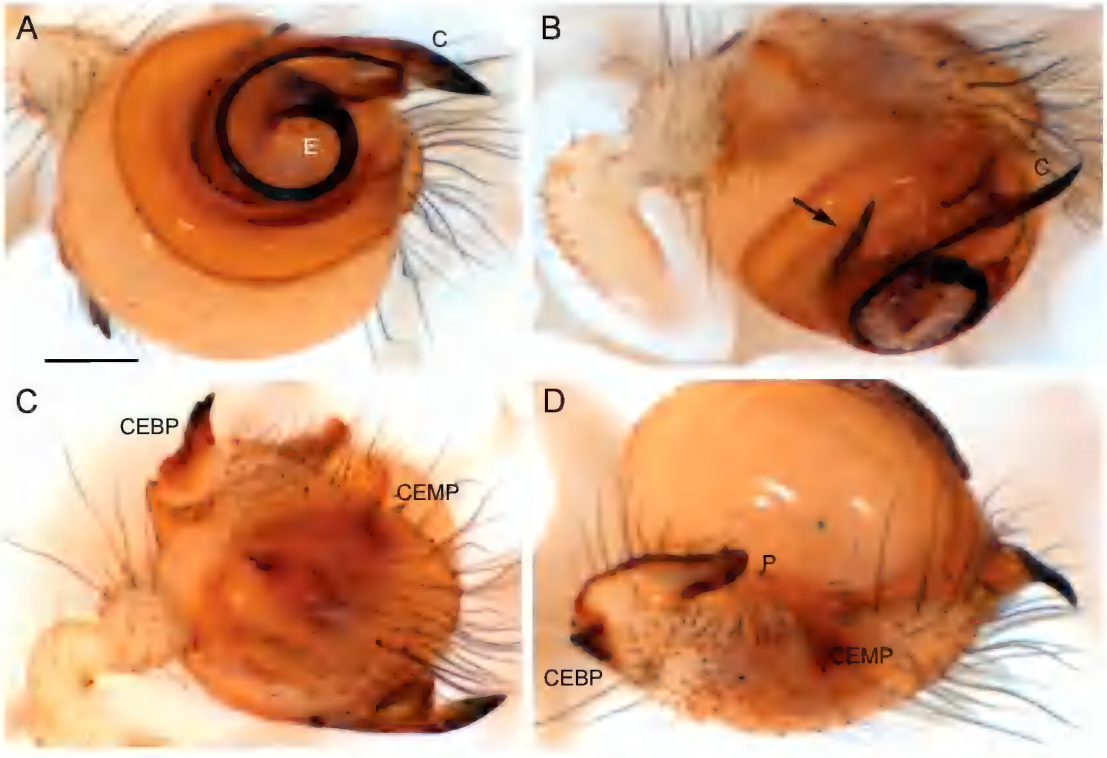

FIGURE 27. *Nanometa purpurapunctata*, pedipalp (TEAU025). **A.** Ventral. **B.** Mesal, extra conductor apophysis indicated with arrow. **C.** Dorsal. **D.** Ectal. Scale bars: 0.2 mm.

anterior edge (fig. 26F), coxa IV retrolateral not examined with SEM. Femur I length 6.0. Conductor tip with two distal apophyses (figs. 27B, 28E, F, 29A).

VARIATION: Males (N = 2) total length 2.6–2.7, cephalothorax length 1.1–1.7, width 0.9–1.0.

DISTRIBUTION: This species is distributed on the North Island of New Zealand (fig. 37E).

REMARKS: The specimen identified as "*Nanometa* sp. Voucher number FAPDNA066" by Álvarez-Padilla and Hormiga (2011) belongs to *N. purpurapunctata*.

MATERIAL EXAMINED: N = 20. NEW ZEALAND, North Island, Tararua Forest Park, Holdsworth, Loop Trail, 40° 53′ 59.9″ S, 175° 27′ 56.5″ E, 338 m, G. Hormiga & N. Scharff, 14–15 April 2011, 1 male, 1 female (DNA specimen voucher GH1114, 1 female for SEM image voucher TEAU049) GWU; Te Urewera National Park, Lake Waikaremoana, trail to Lake Waikareiti, 38° 44′ 32″ S, 177° 9′ 53.1″ E, 650 m, G. Hormiga & N. Scharff, 6 April 2011, morning collecting, 1 male, 1 female, 15 immatures (adult specimens image voucher number TEAU025 and paratype status) GWU; Te Urewera National Park, Lake Waikaremoana, trail to Lake Waikareiti, 38° 44′ 32″ S, 177° 9′ 53.1″ E, 650 m, G. Hormiga & N. Scharff, 5 April 2011, 1 female, 4 immatures GWU; Te Urewera National Park, Lake Waikaremoana, trail to Lake Waikareiti, 38° 44′ 32″ S, 177° 9′ 53.1″ E, 650 m, G. Hormiga & N. Scharff, 6 April 2011, 1 male, 1 immatures GWU; Tongariro National Park, Lake Rotopounamu Walk, 39° 1′ 14.5″ S, 175° 43′ 58.6″ E, 744 m, G. Hormiga & N. Scharff, 17 April 2011, 9 males, 2 females, 7 immatures. (DNA specimen voucher GH1118) GWU; Tongariro National Park, Lake Rotopounamu Walk, 39°

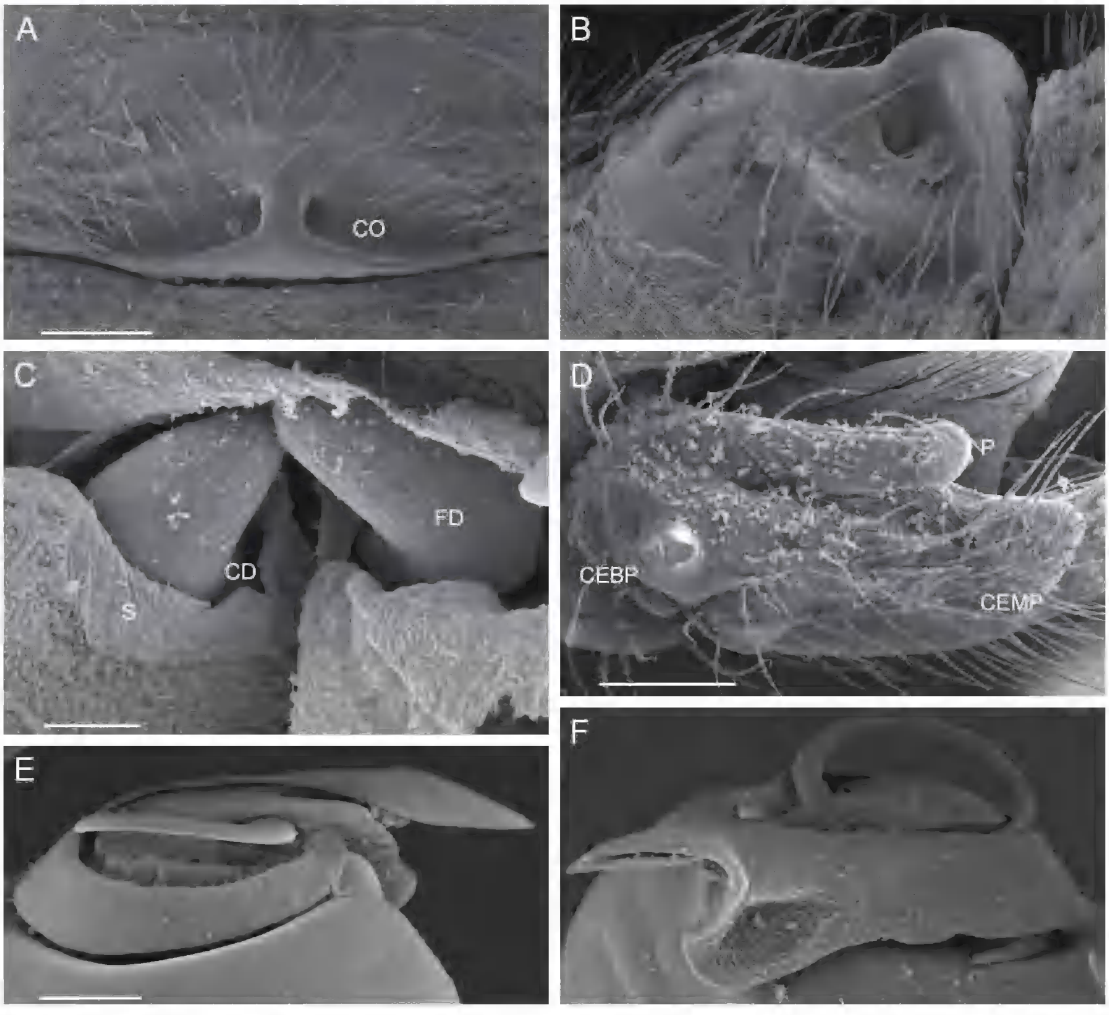

FIGURE 28. *Nanometa purpurapunctata* (female: TEAU049; male: TEAU045). **A.** Epigynum, ventral. **B.** Epigynum, lateral. **C.** Epigynum, dorso-caudal. **D.** Pedipalp, ectal. **E.** Conductor, ectal detail. **F.** Conductor, mesal detail. Scale bars: A, B, D, E, F, 0.1 mm; C, 0.05 mm.

1′ 14.5″ S, 175° 43′ 58.6″ E, 744 m, G. Hormiga & N. Scharff, 17 April 2011, 1 female, 4 immatures (female image voucher number TEAU044) GWU; Tongariro National Park, Lake Rotopounamu Walk, 39° 1′ 14.5″ S, 175° 43′ 58.6″ E, 744 m, G. Hormiga & N. Scharff, 17 April 2011, 1 male, 34 immatures (male image voucher number TEAU045) GWU; Tongariro National Park, Lake Rotopounamu Walk, 39° 1′ 14.5″ S, 175° 43′ 58.6″ E, 744 m, G. Hormiga & N. Scharff, 17 April 2011, 1 female, GWU.

***Nanometa dimitrovi*, sp. nov.**

Figures 30–32, 36–37

"*Nanometa* sp." Álvarez-Padilla and Hormiga, 2011: 802, figs. 87–90, 91A, C (SEMFAP048).

TYPE MATERIAL: Male holotype and female allotype from Australia, Queensland, Bellenden Ker Range, Summit TV Stn. 17° 15′ 59.69″ S, 145° 50′ 1.42″ S, 1560 m. Earthwatch/QLD Museum, 25–31 October 1981; 17 males and 25

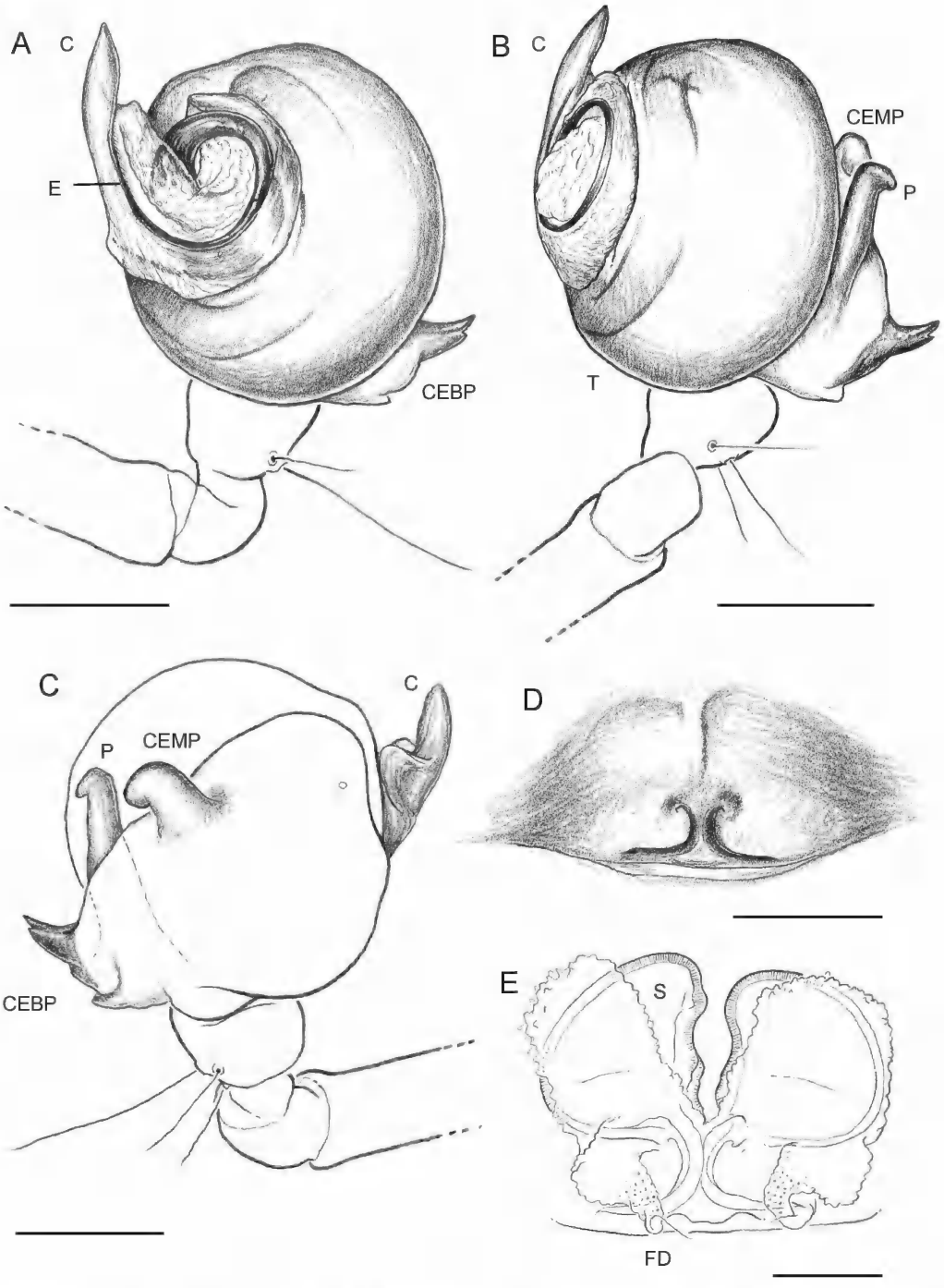

FIGURE 29. *Nanometa purpurapunctata* (male: TEAU051; female: TEAU025). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–D, 0.2 mm; E, 0.1 mm.

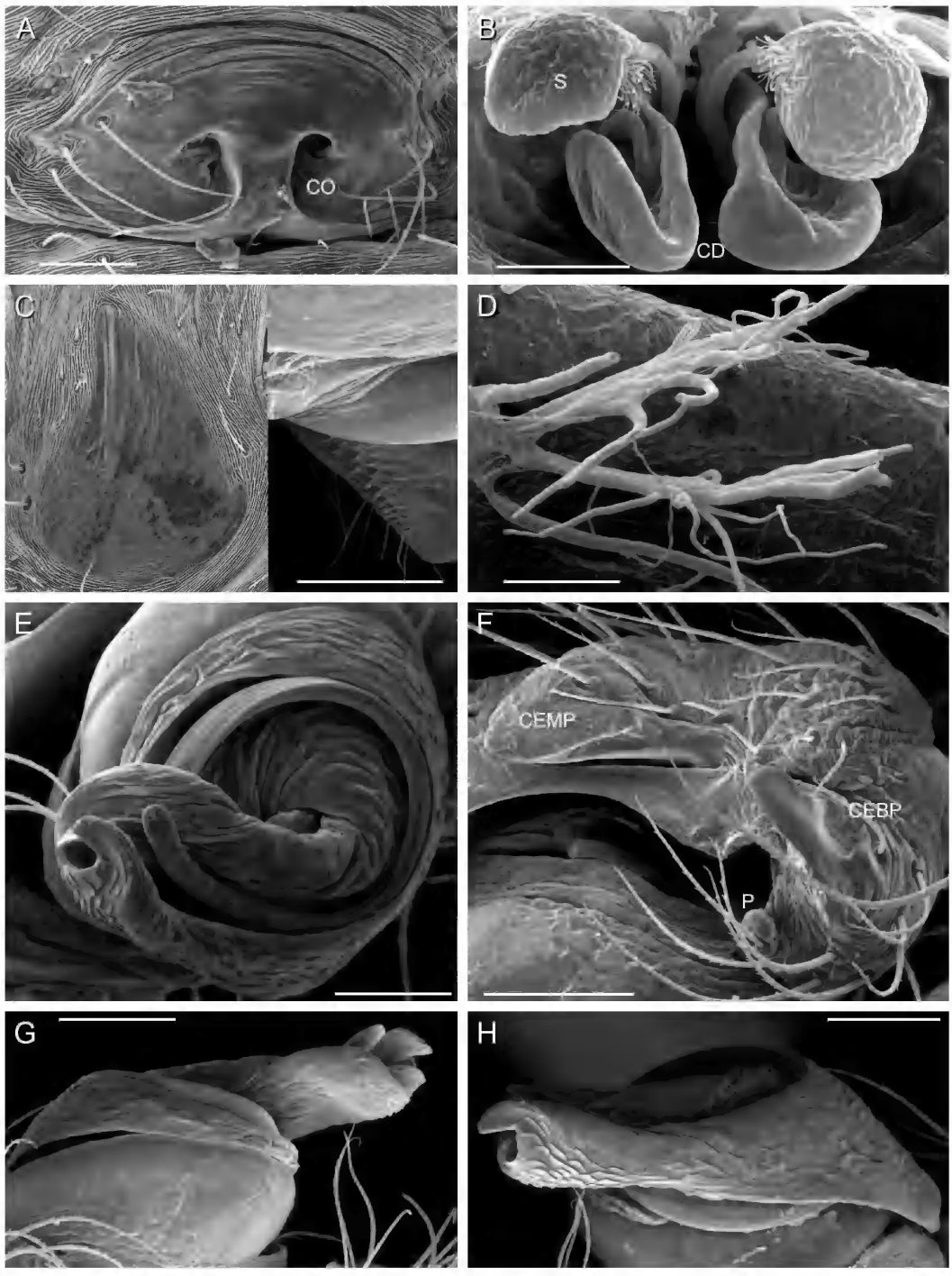

FIGURE 30. *Nanometa dimitrovi* **A.** Epigynum, ventral. **B.** Epigynum, dorsal. **C.** Male, booklung and stridulatory organ and coxal cusps. **D.** Tracheae. **E.** Pedipalp, apical. **F.** Pedipalp, ectal cymbium detail. **G.** Conductor, ectal detail. **H.** Conductor, mesal detail. Scale bars: A, B, E, F, G, H, 0.05 mm; C, D, 0.1 mm.

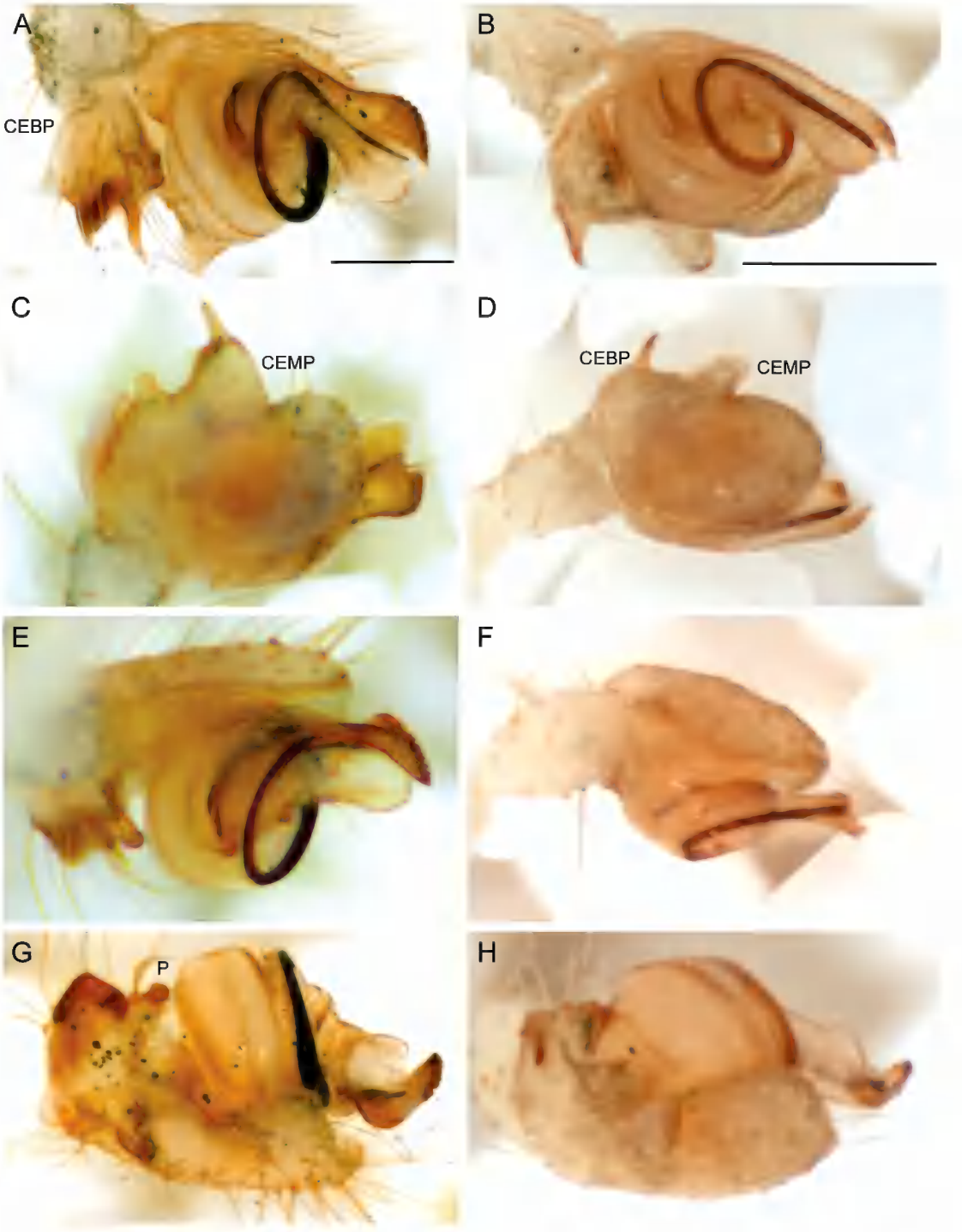

FIGURE 31. *Nanometa dutrorum* (**A, C, E, G**), and *N. dimitrovi* (**B, D, F, H**), pedipalps. **A, B,** Ventral. **C, D,** Dorsal. **E, F**, Mesal. **G, H,** Ectal. Scale bars: 0.2 mm.

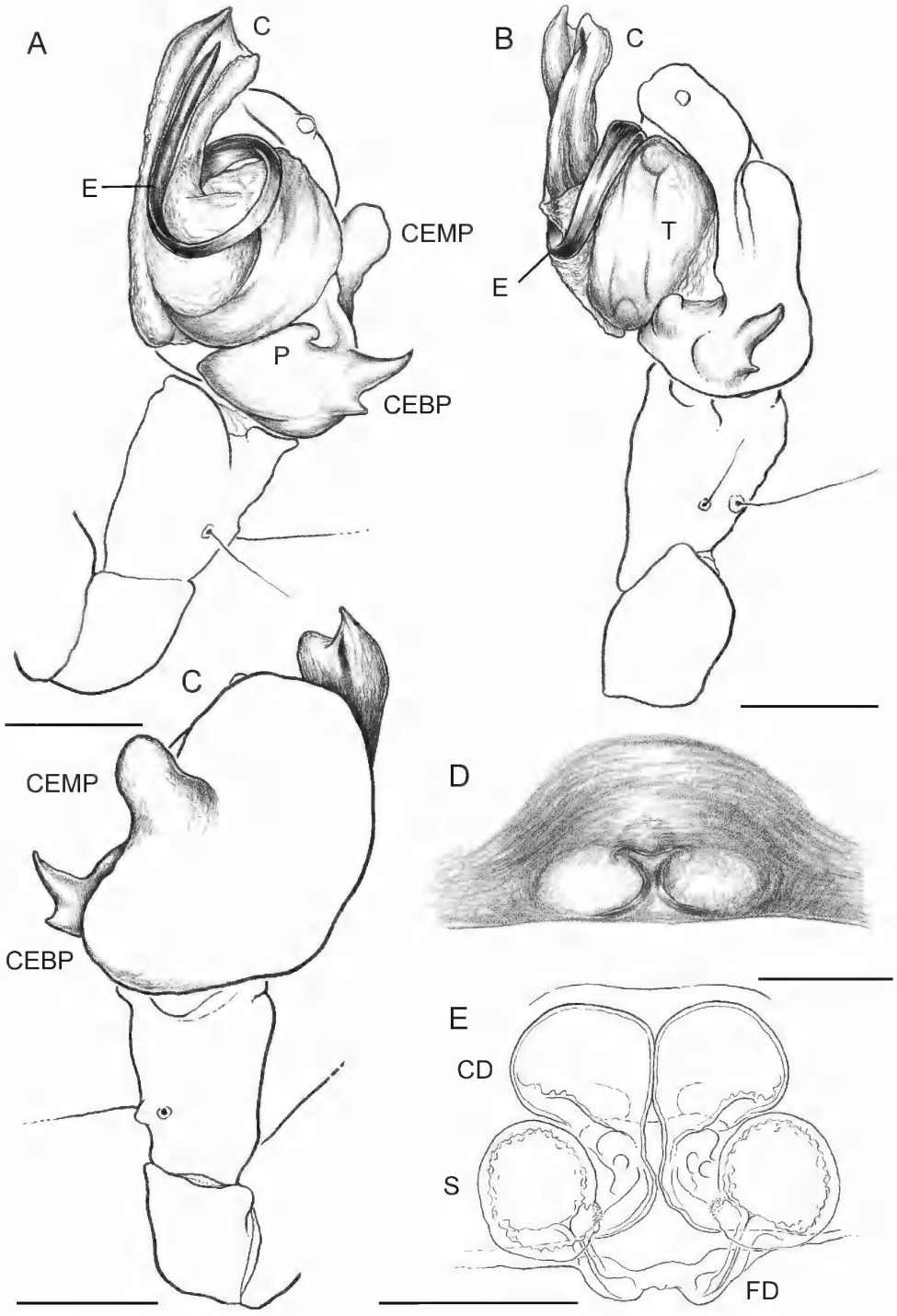

FIGURE 32. *Nanometa dimitrovi* (QM S27687). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: 0.1 mm.

females paratypes from the same locality. Deposited at Queensland Museum (S27687).

DIAGNOSIS: Males of *N. dimitrovi* can be differentiated from the other small *Nanometa* species by its short paracymbium and CEBP (figs. 30F, 31B, D, 32A–C), compared to the long, curved structure of *N. forsteri* (figs. 35B, 36H) and sclerotized, bifurcated *N. dutrorum* (fig. 33A). Females of *N. dimitrovi* can be separated from other small *Nanometa* species by having round and shallow genital openings approximately 1/4 of the epigynum width, located on the center of the epigynal plate and delineated by a "question mark-shaped" sclerotized margin (figs. 30A, 35D, 36F). These genital openings have a similar position in *N. forsteri*, but differ in the septum shape (fig. 36B).

DESCRIPTION: Female (S27683; SEM observations from Álvarez-Padilla and Hormiga, 2011: specimen code SEM-FAP048 from the paratype series S27687) total length 2.3. Cephalothorax length 0.9, width 0.7. Clypeus height 1.0 AME diameter. Cephalothorax background pale yellow light gray concentrated over the ocular area and the carapace lateral edges (fig. 36I). Endites and sternum dark gray. Cheliceral promargin and retromargin each with three teeth, cheliceral denticles present ca. 3. Abdomen dorsum background light gray, silvery guanine patches covering all abdomen dorsal surface, except the central line that extends over only half the abdomen length, lateral surface covered with guanine patches over dorsal half, ventral half with dark-gray pattern, ventral surface dark gray with a central rectangle flanked by two lines of silvery guanine patches. Booklung stridulatory organ absent. Tracheae and epigynum observed with SEM, median tracheal trunks branched; lateral tracheae tubular (fig. 30D). ALS with one major ampullate, one nubbin, ca. 16 piriform, few tartipores present. PMS with one minor ampullate, one nubbin, and one cylindrical and two central aciniform. PLS with araneoid triplet spigots clustered together, ca. five aciniform distributed in one row between the two peripheral cylindrical gland spigots. The anterior cylindrical spigot is considerably thicker than the other. Femur I length 1.24. Copulatory ducts modified as membranous sacs with smooth cuticle, spermathecae round, accessory duct glands clustered on puffball-shaped clusters (figs. 30B, 32E).

Male same as female except as noted. Total length 2.3. Cephalothorax length 1.0 width 0.8. Clypeus 1.1 AME diameter (fig. 36J). Cephalothorax and abdomen coloration slightly darker than in female, silvery guanine patches less conspicuous. Cheliceral promargin and retromargin with three and two teeth respectively, cheliceral denticles present ca. three. Stridulatory organ formed by a cuticular ridge on the booklung anterior edge, coxa IV retrolateral surface covered with small teeth opposite to the booklung ridge (fig. 30C). Femur I length 1.6. Pedipalp with small paracymbium and spikelike CEBP (figs. 30F, 31B, D). Conductor tip with one distal blunt apophysis and cuticle covered with scales (figs. 30E, GH, 31F, H).

VARIATION: Females ($N = 3$) total length 2.3–2.6, cephalothorax length 0.9–1.0, width 0.7–0.8. The epigynum septum and the epigynal plate vary on their width.

ETYMOLOGY: The species epithet honors our colleague Dimitar S. Dimitrov for his many contributions to the study of spider systematics.

DISTRIBUTION: *Nanometa dimitrovi* is found in tropical Queensland (fig. 37C).

MATERIAL EXAMINED: $N = 47$. AUSTRALIA, North East Queensland, Bellenden Ker Range, NQ Cable Tower 3, 17° 15′ 29.85″ S, 145° 50, 17.83″ E, 1054 m, 17–24 October 1981. 1 female S26341 Queensland Museum. 1 female, 4 males S26352. 1 male, QM S27684; Bellenden Ker, Center Peak Summit, 17° 16′ 0″ S, 145° 51′ 0″ E, 1500 m, G.B. Monteith, 10 April 1979, 2 females, QM S27683; Bellenden Ker Range, Summit TV Station, 17° 15′ 59.69″ S, 145° 50′ 1.42″ E, 1560 m, Earthwatch/QLD Museum, 25–31 October 1981, 17 males 25 females, 42 immatures, QM S27687; Bellenden Ker Range, Summit TV Station, 17° 15′ 59.69″ S, 145° 50′ 1.42″ E, 1560 m, Earthwatch/QLD Museum, 25–31 October 1981,

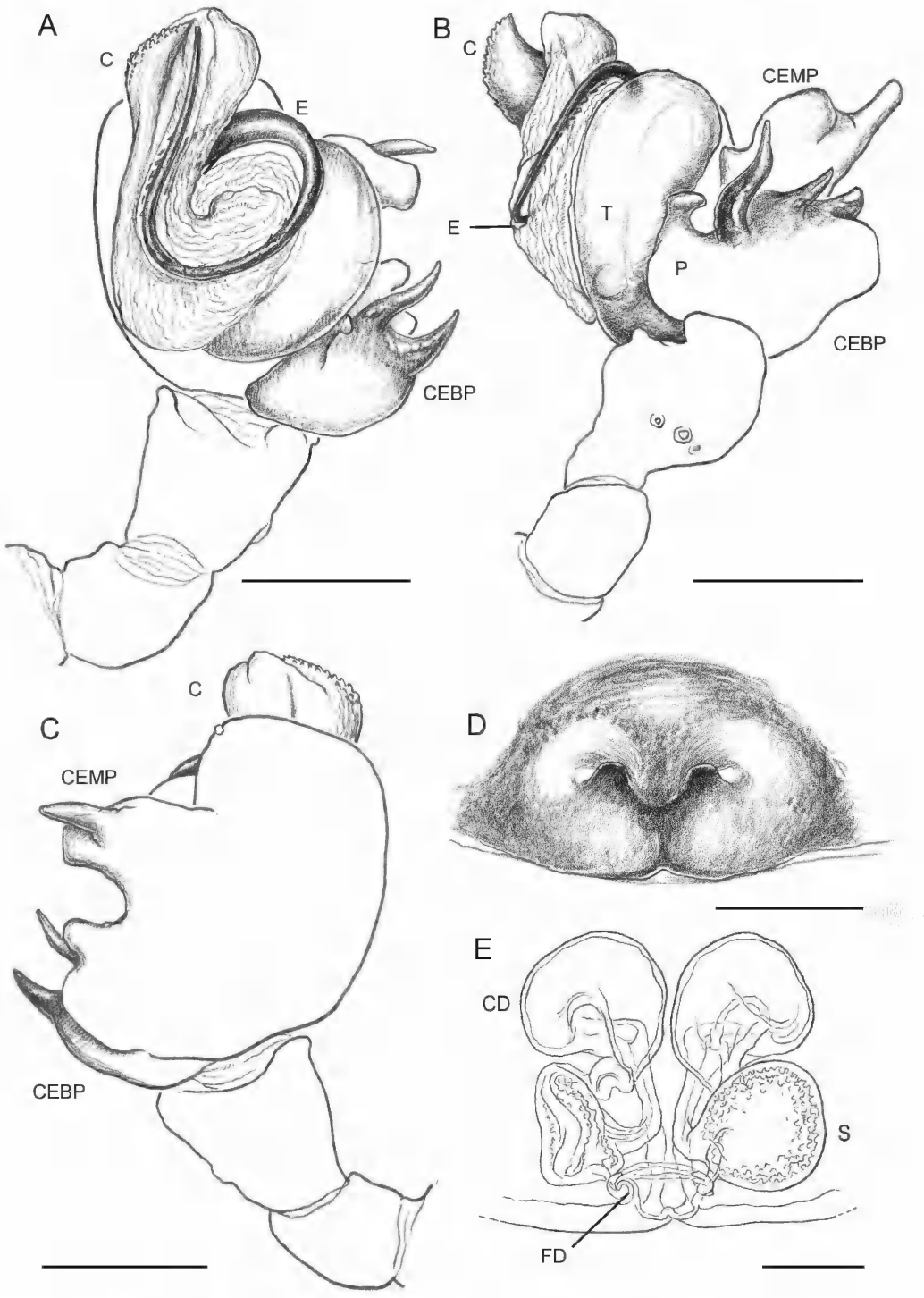

FIGURE 33. *Nanometa dutrorum* (GH0128). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–D, 0.2 mm; E 0.1 mm.

1 male, 1 female, S27687. Bellenden Ker Range, Summit TV Station, 17° 15′ 59.69″ S, 145° 50′ 1.42″ E, 1560 m, Earthwatch/QLD Museum, 1–7 October 1981, 1 male, S27682; Bellenden Ker Range, Summit TV Station, 17° 15′ 59.69″ S, 145° 50′ 1.42″ E, 1560 m, Earthwatch/QLD Museum, 25–31 October 1981, 5 males, 1 female S27695; Eungella National Park, Dalyrymple Road, 2.9 km NE of Snake Road Junction, 20 April 1998, G. Milledge, 1F, KS 52416.

Nanometa dutrorum, sp. nov.

Figures 31, 33, 36–37

TYPE MATERIAL: Male holotype and female allotype from Australia, Tasmania, Weldborough Pass Scenic Reserve, 28.6 km 280° WNW St Helens, 41° 12′ 59.8″ S, 147° 56′ 18.2″ E, 480 m. G. Hormiga, L. Lopardo. 6–7 March 2006. *Nothofagus* forest (male specimen also DNA voucher GH0128), both types deposited at the Tasmanian Museum and Art Gallery (Hobart).

DIAGNOSIS: Males of *N. dutrorum* can be differentiated from the other small *Nanometa* species by having the CEMP bearing a conspicuous apophysis (figs. 31C, 33C), and the CEBP having only two small apophyses and a square cymbial outgrowth (figs. 31A, 33A). The conductor tip is covered with several sclerotized denticles (figs. 31A, E, G, 33A–C) and the embolus is marginally serrated. Females of *N. dutrorum* can be separated from other small *Nanometa* species by having oval and shallow genital openings approximately 1/2 of the epigynum width, located at the center of the epigynal plate (figs. 33D, 36D). Genital opening rebordered by thick cuticular margin, septum discontinuous near the genital openings' posterior margin (fig. 36D).

DESCRIPTION: Female (GH0128) total length 4.1. Cephalothorax length 1.4, width 1.2. Clypeus height 1.0 AME diameter. Cephalothorax background pale-yellow, with light-gray coloration concentrated over the ocular area and the carapace lateral edges. Endites and sternum color dark gray. Cheliceral promargin and retromargin each with three and two teeth, with ca. three cheliceral denticles. Abdomen dorsum background light gray, silvery guanine patches covering all abdomen dorsal surface, except the central line that extends all the abdomen length, lateral surface covered with guanine patches over dorsal half, ventral half with brown pattern, ventral surface brown intercalated with silvery guanine patches and with a central rectangle flanked by two lines. Booklung stridulatory organ absent. Tracheae and epigynum not observed with SEM. Femur I length 2.4. Copulatory openings small, shallow, ovate, forming Y-shaped pattern between them and cuticular margin. Copulatory duct enlarged, similar in size to spermathecae.

Male (GH0128) same as female except as noted. Total length 3.4. Cephalothorax length 1.5 width 1.3. Clypeus 1.1 AME diameter. Cephalothorax and abdomen coloration slightly darker than in female, silvery guanine patches less conspicuous. Cheliceral promargin and retromargin with three and two teeth respectively, with ca. three cheliceral denticles. Stridulatory organ formed by a cuticular ridge on the booklung anterior edge, coxa IV retrolateral surface not observed with SEM. Femur I length 3.0. Pedipalp with two-pronged CEBP (figs. 31A, 33A–C), paracymbium small (figs. 31A, 33A), CEMP with long apophysis (fig. 33B), conductor denticulated and embolus with marginal serration (figs. 31A, E, 33A–C).

VARIATION: Females ($N = 2$) total length 3.9–4.1, cephalothorax length 1.3–1.4, width 1.0–1.1.

ETYMOLOGY: The species epithet is a patronym in honor of paleontologist John Thomas Dutro (1923–2010) and his wife Nancy P. Dutro, for their boundless generosity to G.H.

DISTRIBUTION: This species is found in Tasmania and Victoria (fig. 37D).

MATERIAL EXAMINED: $N = 3$. AUSTRALIA, Tasmania, St. Columbia Falls, 27.1km 256° W St Helens, 41° 19′ 17.2″ S, 147° 55′ 33.7″ E, 335 m, G. Hormiga & L. Lopardo, 7 March 2006, *Eucalyptus/Casuarina* woodland, 1 male, GWU. Victoria, Mt. St. Leonard, 37° 34′ S, 145° 32′ E, 6 April 1991, M.S. Harvey, M.E. Blosfelds, NMV.

FIGURE 34. *Nanometa forsteri* (GH1139), pedipalps. **A,** Ventral. **B,** Dorsal. **C,** Mesal. **D,** Ectal. Scale bars: 0.2 mm.

Nanometa forsteri, sp. nov.

Figures 34–37

TYPE MATERIAL: Male holotype and female allotype from New Zealand, South Island, Arthur's Pass National Park, Bridal Veil Track, 42° 55′ 49.6″ S, 171° 33′ 43.4″ E, 819 m. 4–5 February 2012, G. Hormiga, N. Scharff, J. Pedersen, voucher code GH1139. Both deposited at MONZ.

DIAGNOSIS: *Nanometa forsteri* can be differentiated by the following combination of characters: eyes arranged in two lines and subequal in size, with juxtaposed lateral eyes (figs. 36A, G, H). Males of *N. forsteri* can be distinguished from other small *Nanometa* species by having the CEBP apophysis longer than this process (figs. 34A–D, 35A–C), and from *N. gentilis* in particular by having this apophysis with its tip bent posteriorly. Both *Nanometa forsteri* and *N. gentilis* have conductor tips C-shaped, but in *N. forsteri* the basal apophysis is wider and with a blunt tip (figs. 34A, B, 35A). Females of *N. forsteri* can be separated from other small *Nanometa* species by having ovate and deep genital openings, approximately half of the epigynum width, located on the posterior half of the epygynal plate and separated by a triangular septum, approximately half the size of these openings (figs. 35D, 36B).

DESCRIPTION: Female total length 3.3. Cephalothorax length 1.1, width 1.0. Clypeus height 1.0 AME diameter. Cephalothorax background pale yellow, light-gray coloration concentrated over the ocular area and the carapace lateral edges (fig. 36A). Endites and sternum color dark brown (fig. 36C). Cheliceral promargin and retromargin with three and two teeth respectively, cheliceral denticles present ca. 2. Abdomen dorsum background light gray, silvery guanine patches covering all abdomen dorsal surface, except the central line (fig. 36A), lateral surface covered with guanine patches over its dorsal half, ventral half with brown pattern (fig. 36E), ventral surface with a central brown rectangle, flanked by a line of silvery guanine patches (fig. 36C). Booklung stridulatory organ absent. Femur I length 1.8.

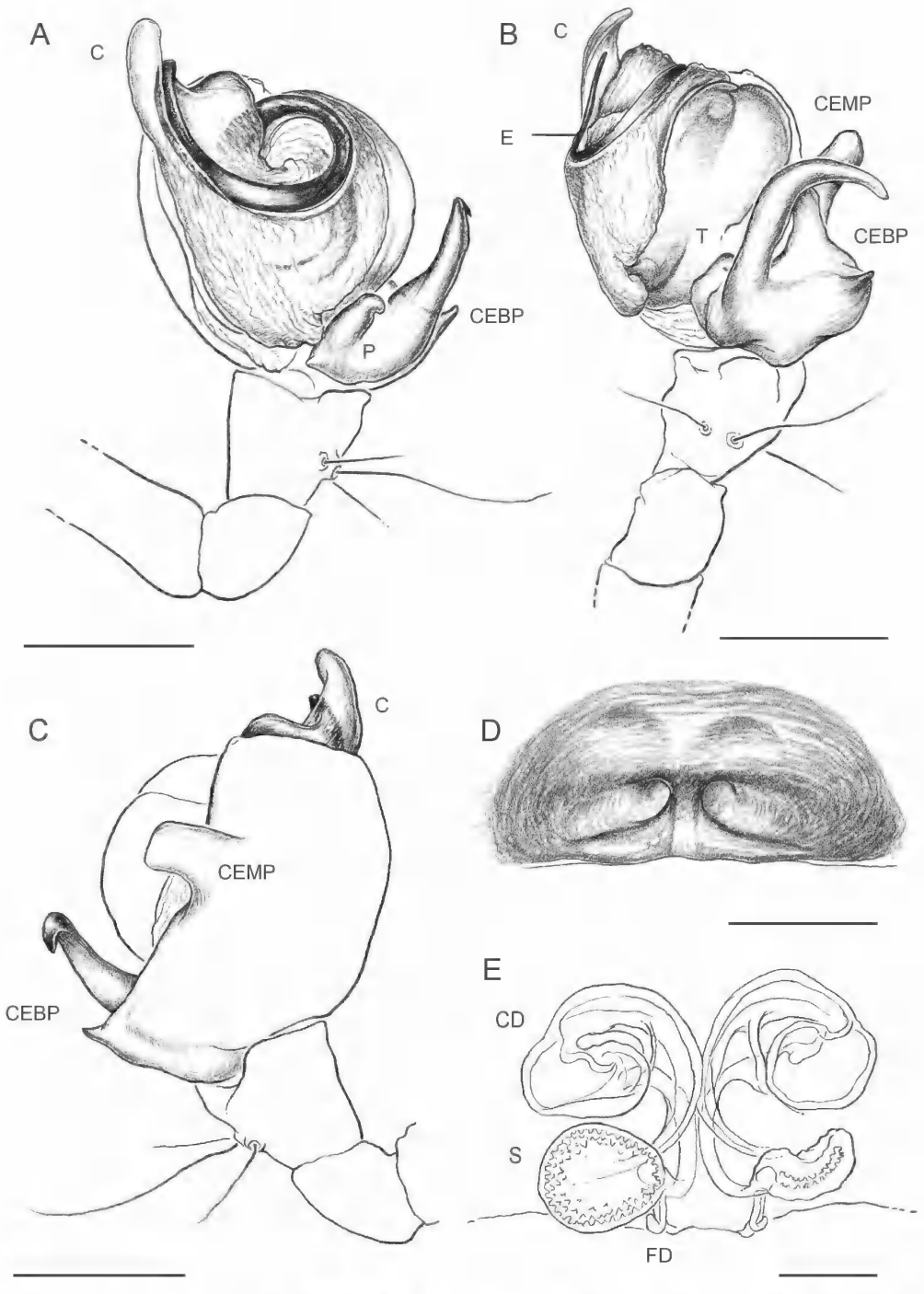

FIGURE 35. *Nanometa forsteri*. (GH1139). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–D, 0.2 mm; E, 0.1 mm.

FIGURE 36. *Nanometa forsteri* (GH1139; **A–C, E, G, H**), *N. dutrorum* (GH0128; D), and *N. dimitrovi* (QM S27687; **F, I, J**). **A.** Female, dorsal habitus. **B.** Epigynum, ventral. **C.** Female, ventral habitus. **D.** Epigynum, ventral. **E.** Female, lateral habitus. **F.** Epigynum, ventral. **G.** Female, frontal. **H.** Male, frontal. **I.** Female, frontal. **J.** Male, frontal. Scale bars: A, C, E, 1.0 mm; B, D, F–J, 0.2 mm.

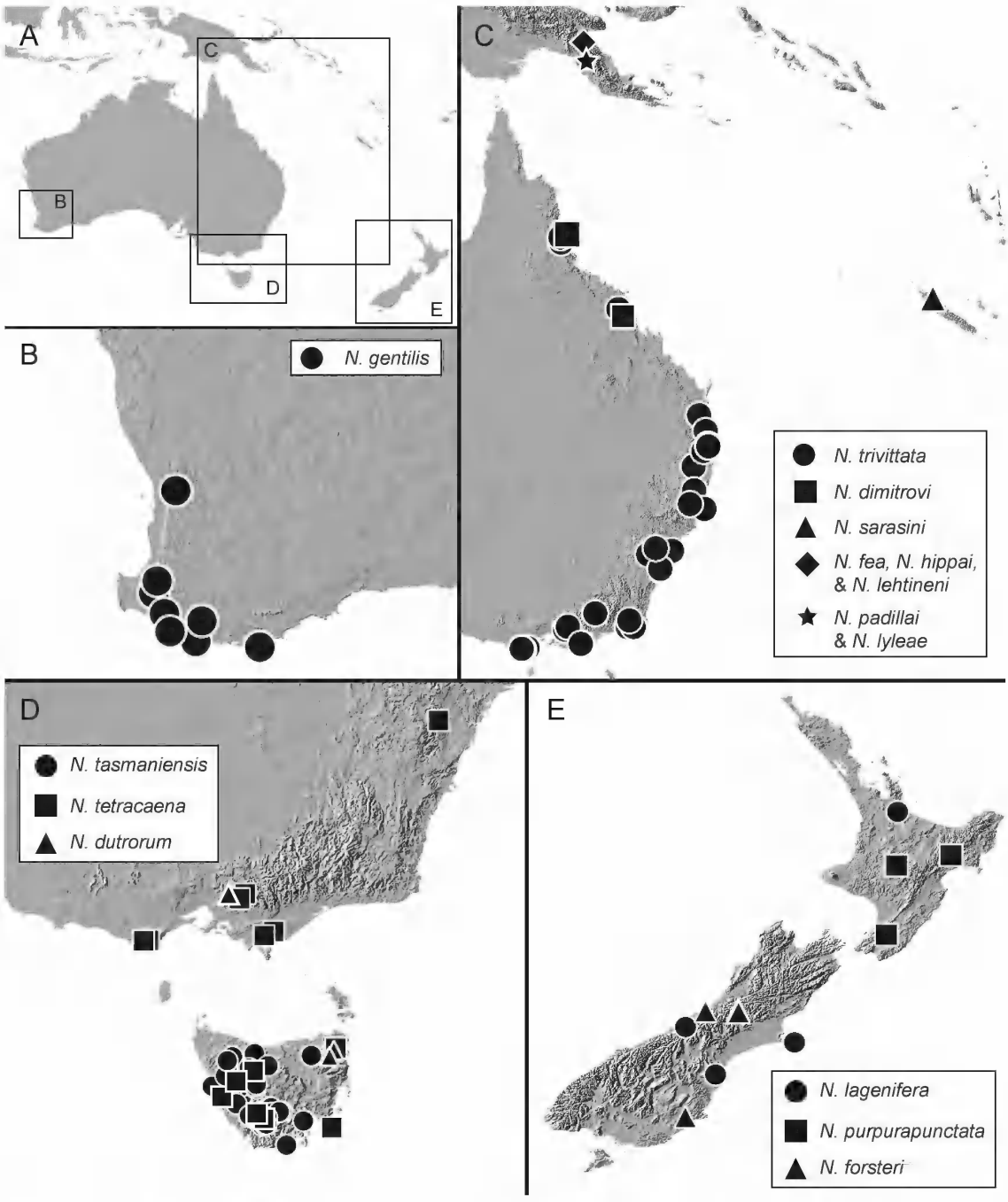

FIGURE 37. Distribution of *Nanometa* in Australia, New Zealand, New Caledonia, and Papua New Guinea. **A.** Map of region with areas of importance indicated. **B.** Western Australia. **C.** Eastern Australia, Papua New Guinea, and New Caledonia. **D.** Southeastern Australia and Tasmania. **E.** New Zealand.

Trachea, spinnerets not observed with SEM. Internal genital structures not observed. Epigynum typical of the genus (figs. 35D, E, 36B). Description based on specimen (GH1139).

Male same as female except as noted. Total length 2.4. Cephalothorax length 1.72 width 1.0. Clypeus 0.6 AME diameter. Cephalothorax and abdomen coloration lighter than in female, silvery guanine patches less conspicuous. Chelicheral promargin and retromargin with three and two teeth respectively, cheliceral denticles present ca. 2. Stridulatory organ formed by a cuticular ridge highly sclerotized on the booklung anterior edge, coxa IV retrolateral not examined with SEM. Femur I length 1.8. CEBP tip with a small tooth (figs. 34D, 35A–C). CEMP square in shape and ca. 1/4 of the cymbium length (figs. 34B, 35C). Conductor distal apophyses surface smooth, tip C-shaped (figs. 34, 35A–C). Description based on specimen (GH1139).

VARIATION: Females (N = 2) total length 3.2–3.3, cephalothorax length 1.1–1.2, width 0.9–1.0.

ETYMOLOGY: The specific epithet is a patronym honoring Raymond R. Forster (1922–2000) and his contributions to arachnology. Among his innumerable discoveries, he is credited with being the first arachnologist to identify nanometines as a natural group.

DISTRIBUTION: This species is found only on the New Zealand South Island (fig. 37E).

NATURAL HISTORY: *Nanometa forsteri* builds small horizontal orb webs on the lower vegetation.

MATERIAL EXAMINED: N = 9. NEW ZEALAND, South Island, Arthur's Pass National Park, Bridal Veil Track, 42° 55′ 49.6″ S, 171° 33′ 43.4″ E, 819 m, G. Hormiga, N. Scharff, & J. Pedersen, 4–5 February 2012, 3 males, 5 females, MCZ (1 female, DNA voucher GH1139); Waimakariri Velley Road, forest close to campground, 43° 0′ 28.8″ S, 171° 34′ 22.7″ E, 655 m, G. Hormiga, N. Scharff, & J. Pedersen, 4 February 2012, sifted litter, 1 female, GWU; Waitaha Rd., between Greymouth and Franz Josef Glacier, nr. Kakapotahi, 42° 58′ 49.253″ S, 170° 42′ 10.71″ E, 50 m, G. Hormiga, G. Giribet, M. Arnedo, R. Fernández, F. Álvarez-Padilla, R.J. Kallal, & C. Baker, 17 January 2016, GWU; Woodside Glen Track, nr. Outram, 45° 51′ 14.274″ S, 170° 10′ 18.875″ E, 88 m, G. Hormiga, G. Giribet, M. Arnedo, R. Fernández, F. Álvarez-Padilla, R.J. Kallal, & C. Baker, 22 January 2016, 1 female GWU.

SUBFAMILY LEUCAUGINAE CAPORIACCO, 1955

Leucauginae Caporiacco, 1955: 318.
Leucauginae Álvarez-Padilla et al., 2009: 138.
Type genus: *Leucauge* White, 1841.

Genus ***Harlanethis***, gen. nov.

Figures 38–44, 60

TYPE SPECIES: *Harlanethis lipscombae*.

DIAGNOSIS: *Harlanethis* species are similar to other leucaugine genera in having femoral trichobothria and silver guanine abdominal patches (fig. 38A, C–D), but can be easily separated from other leucaugines by the presence some unique features among tetragnathids such a whitish, lightly sclerotized triangular epigynal protrusion (fig. 39C, D); two anterior longitudinal deep grooves on the epigynum venter (fig. 41A); and by having the epigynum almost the same size as the sternum (fig. 38C). Males are diagnosed by their massive conductor, which is wider than long and formed by three sclerites united by a membrane (figs. 39G, H, 41B, 42G, 43F). The embolus morphology is diagnostic, being very thick, tubular, slightly curved, and apically covered with small scales (figs. 41B, C, 42G). In males, the ventral cuticle of the paturon has four deep grooves intercalated with transverse ridges (figs. 38F, H, 41H).

DESCRIPTION: Female total length 3.99–5.25. Cephalothorax length 1.72–1.87, width 1.30–1.38. Carapace glabrous, pale yellow to light brown, slightly darker over the cephalic region and carapace margins. Fovea deep, triangular in shape, carapace dorsal pits absent (fig. 38A). Clypeus height 0.9 to 0.7 AME diameter, cuticle darker

FIGURE 38. *Harlanethis weintrauborum* (male: TEAU016; female: TEAU017). **A.** Female, dorsal habitus. **B.** Female, frontal habitus. **C.** Female, ventral habitus. **D.** Female, lateral habitus. **E.** Male, frontal habitus. **F.** Female, chelicera ventral view. **G.** Male, frontal view of endites with stridulating cuticle highlighted with arrow. **H.** Male, chelicerae ventral view with striae highlighted with arrow. Scale bars: A, C, D, 1 mm; B, –E, 0.5 mm; F–H, 0.2 mm.

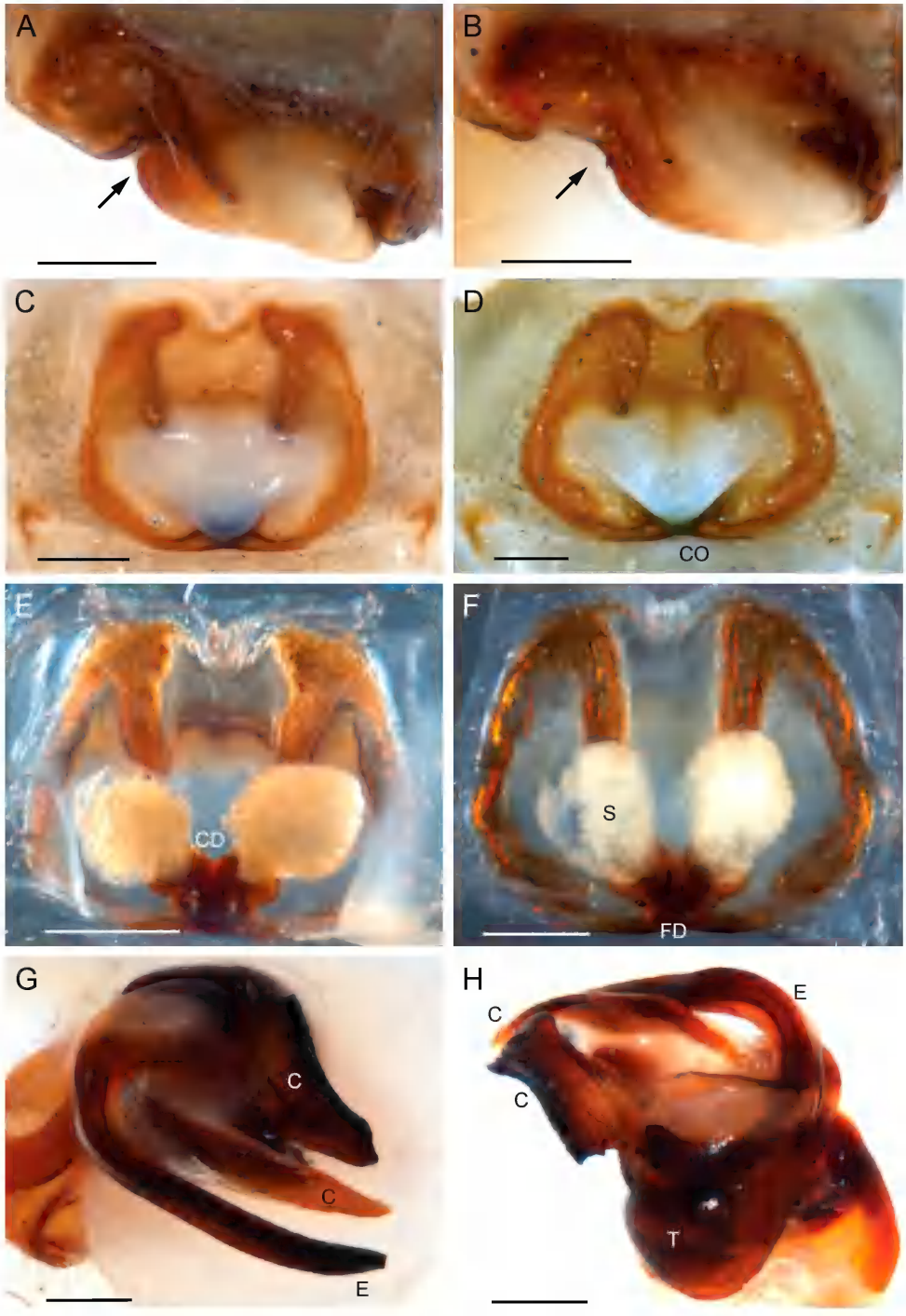

FIGURE 39. *Harlanethis lipscombae* (female: TEAU019, TEAU048; male: TEAU038; **A, C, E, G, H**) and *H. weintrauborum* (TEAU017, TEAU050; **B, D, F**). **A, B.** Epigynum, lateral, with arrow indicating anterior margin of epigynal protrusion. **C, D.** Epigynum, ventral. **E, F.** Epigynum, dorsal digested. **G.** Pedipalp, expanded, apical. **H.** Pedipalp, expanded, ventral. Scale bars: 0.2 mm.

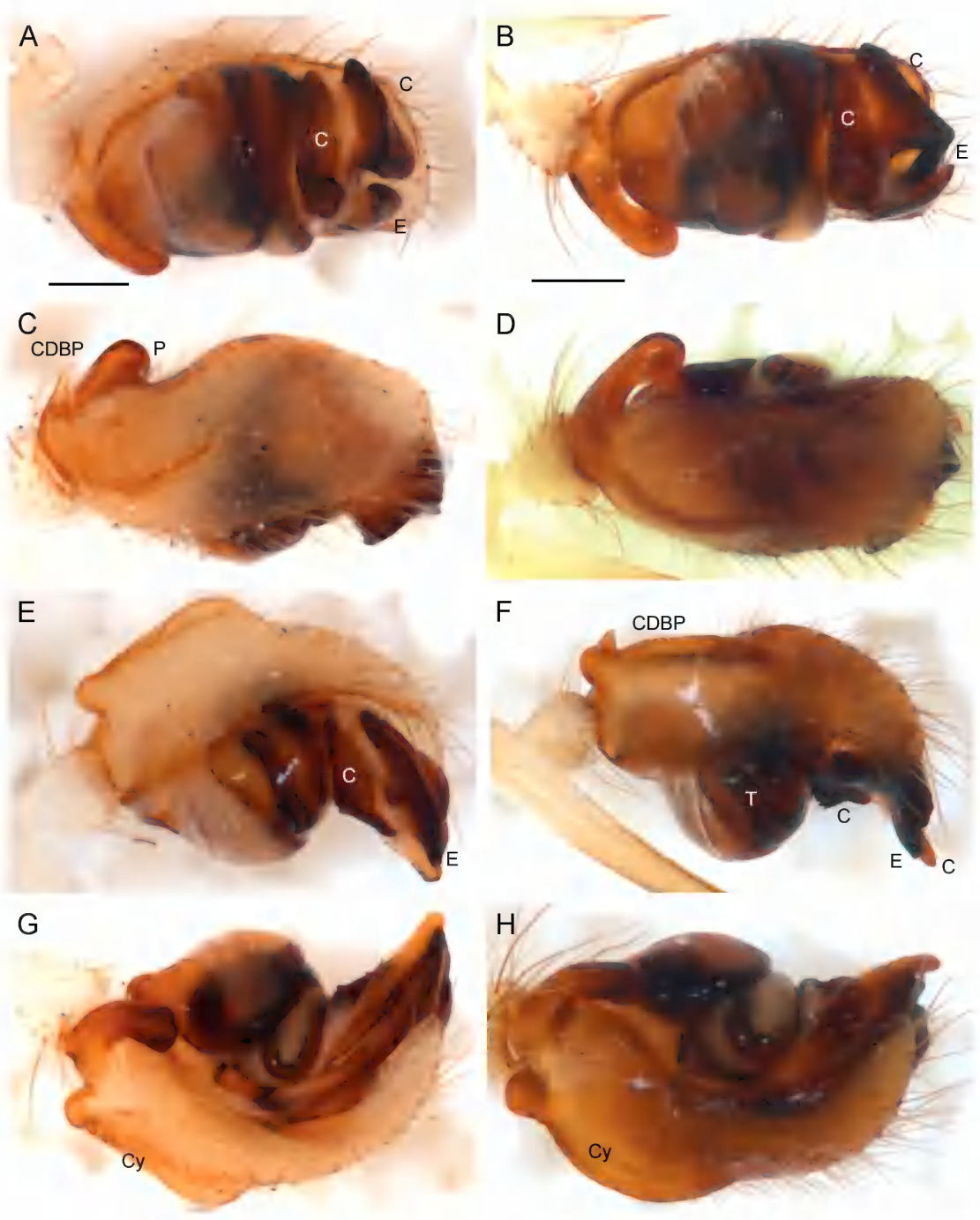

FIGURE 40. *Harlanethis lipscombae* (TEAU038; **A, C, E, G**), and *H. weintrauborum* (TEUA016; **B, D, F, H**). **A, B.** Pedipalp, ventral. **C, D.** Pedipalp, dorsal. **E, F.** Pedipalp, mesal. **G, H.** Scale bars: 0.2 mm.

under the median eyes and paler under the lateral eyes (figs. 38B). AME slightly larger than PME. Lateral eyes on the same tubercle, one AME diameter apart from median eyes and approximately half that size. Chelicerae with few scattered setae, cuticle smooth, without ventral stridulatory ridges (fig. 38F), with three promarginal and two retromarginal teeth (figs. 38B, F). Endites longer than wide, dark brown, internal margins pale yellow. Labium rectangular, wider than long, colored as the endites. Sternum dark brown, trapezoidal in shape, wider between the first two legs (fig. 38C). Abdomen dorsally covered with silvery guanine patches over a background pale to dark gray, with a dark median longitudinal line, lateral surfaces with diffused dark vertical stripes; ventrally dark brown, with guanine patches concentrated in four spots forming a central rectangle (figs. 38A, C–D). Booklung covers without stridulatory striae. Spinnerets pale yellow to brown, lighter pattern on internal surfaces. Leg formula 1-2-4-3. Femur I length 2.96–3.67. First pair considerably larger, femora and tibia brown-yellow with dark-brown annuli. Second pair femora and tibiae pale yellow without annulation. Metatarsi and tarsi dark yellow. All leg segments dark brown apically. Femora III and IV with ca. six prolateral trichobothria, distributed around the base, flagellum smooth (fig. 41G). Femora with few setae, other segments hirsute increasing after tibiae. All leg segments with few macrosetae, except tarsi, which are glabrous. Epigynum: trapezoidal shape wider than long. Copulatory openings medially located on both sides of posterior margin of triangular epigynal protrusion (fig. 41A, D). Spermathecae membranous, internal surfaces covered with accessory gland ducts (figs. 39E, F, 41E). Copulatory ducts short, enclosing the spermathecae entrance, both copulatory ducts converging into a common sclerotized base where the fertilization ducts also originate (figs. 39E, F, 44C–D). Fertilization ducts short, straight.

Male same as female except as noted. Total length 3.86–4.15. Cephalothorax length 1.71–1.76, width 1.35–1.46. Carapace dorsal coloration white to dark yellow. Clypeus height 0.83–0.91 AME diameter, pale yellow. Sternum pale yellow to brown. Chelicerae pale to dark brown, slightly longer and narrower, dorsal cuticle rugose, setal bases enlarged and more abundant at base; ectal cuticle less rugose toward the ventral and apical surfaces (fig. 38E); ventral cuticle with four deep grooves intercalated with transverse ridges (figs. 38H, 41H); with three promarginal and three to four retromarginal teeth (fig. 38E, H). Endites brown; dorsal cuticle without obvious complementary structures to the cheliceral striae (fig. 38G). Abdominal pattern as in female, but lighter in coloration. Femur I length 3.65–4.17. Legs pale yellow, annulation less pronounced than in female. Pedipalpal tibia triangular, as long as wide, apical margin wider. CDBP shaped as a long curved ridge with its basal portion forming a small triangular spur (figs. 40C–F, 41F, 42C). Paracymbium cylindrical, almost glabrous, slightly curved, apically swollen, its cymbium attachment membranous (fig. 38G, H). Embolus very thick, tubular, slightly curved and apically covered with small scales (fig. 41B, C).

Composition: This new genus includes two species: *Harlanethis lipscombae* and *H. weintrauborum.*

Systematics: This genus is placed in the subfamily Leucauginae (figs. 61–63), nested in a clade including *Mesida* Kulczyński, 1911, *Tylorida* Simon, 1894, and *Orsinome.* The monophyly of *Harlanethis* is supported by the following morphological synapomorphies: massive highly sclerotized conductor, wider than long and formed by three sclerites united by a membrane (figs. 38G, H, 42E, G) and the large lightly sclerotized triangular epigynal protrusion with two anterior longitudinal deep grooves on the epigynum venter (fig. 39A–D).

Etymology: TThis new genus is named by the third author (G.H.) to honor Wilbur B. (Bill) Harlan, whose endowment to the Department Biological Sciences of the George Washington University has empowered numerous young biologists scholarly work. This name is compounded with *nethis,* the Greek work for spinster, i.e., a woman who

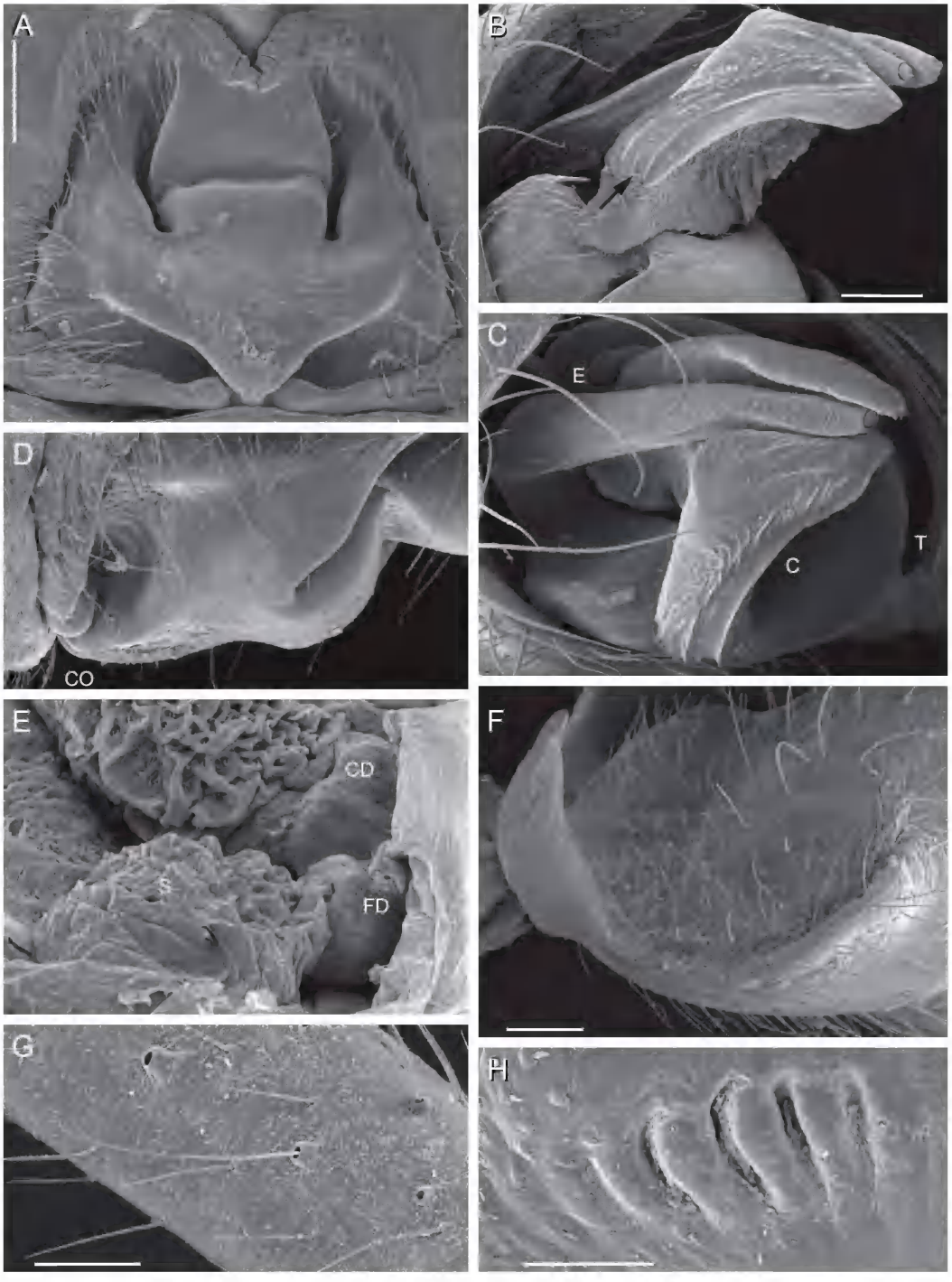

FIGURE 41. *Harlanethis lipscombae* (TEAU038). **A.** Epigynum, ventral. **B.** Embolus and conductor detail. **C.** Conductor and embolus, apical. **D.** Epigynum, lateral. **E.** Epigynum, dorsolateral. **F.** Pedipalp, CDBP detail. **G.** Femur IV trichobothria. **H.** Male, cheliceral striae. Scale bars: A–G, 0.1 mm; H, 0.05 mm.

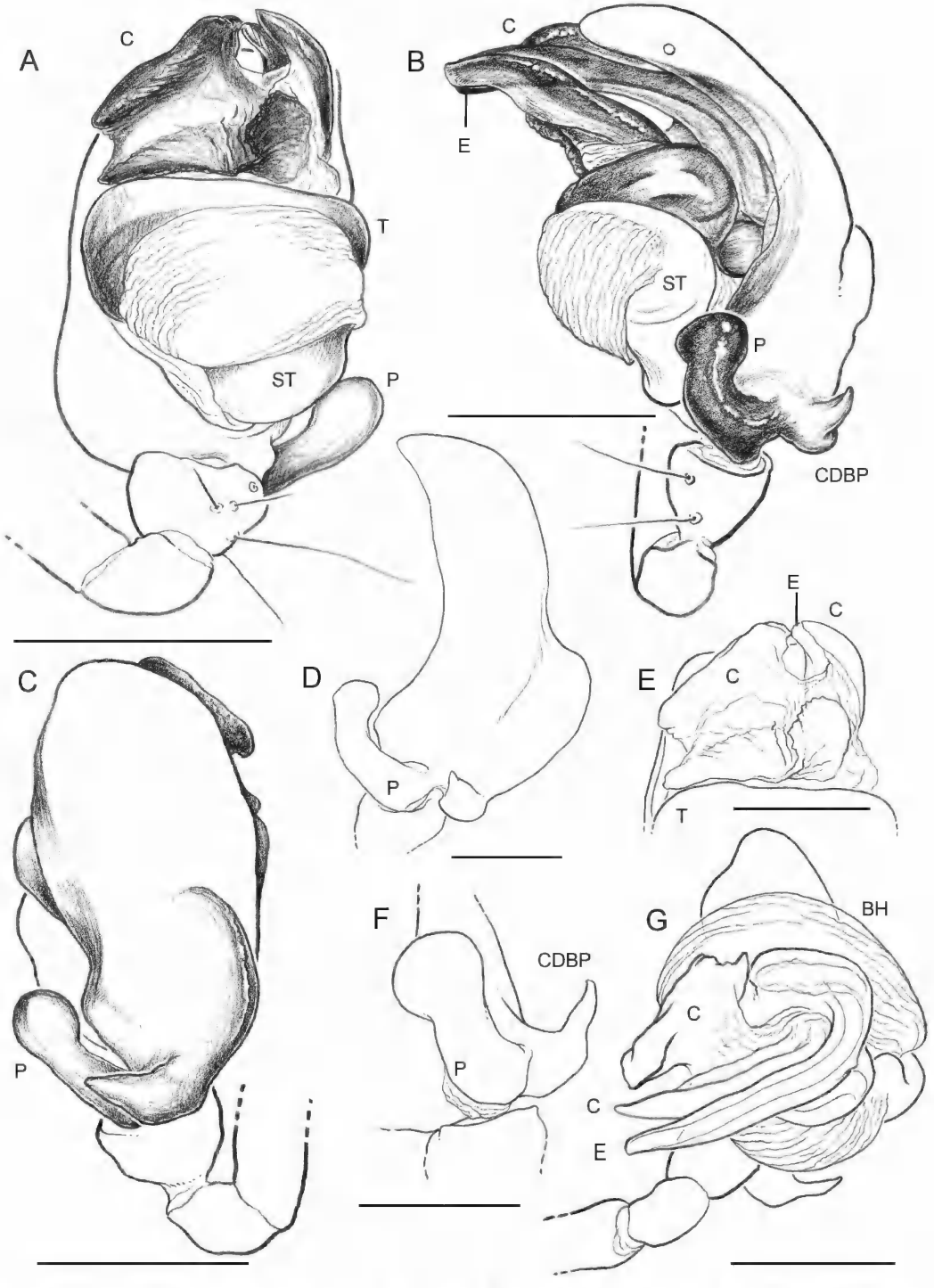

FIGURE 42. *Harlanethis lipscombae* (KS 52425; TEAU038). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Pedipalp, ectodorsal. **E.** Conductor and embolus, ventral detail. **F.** Pedipalp CDBP, ventral detail. **G.** Pedipalp expanded, apical. Scale bars: 0.5 mm.

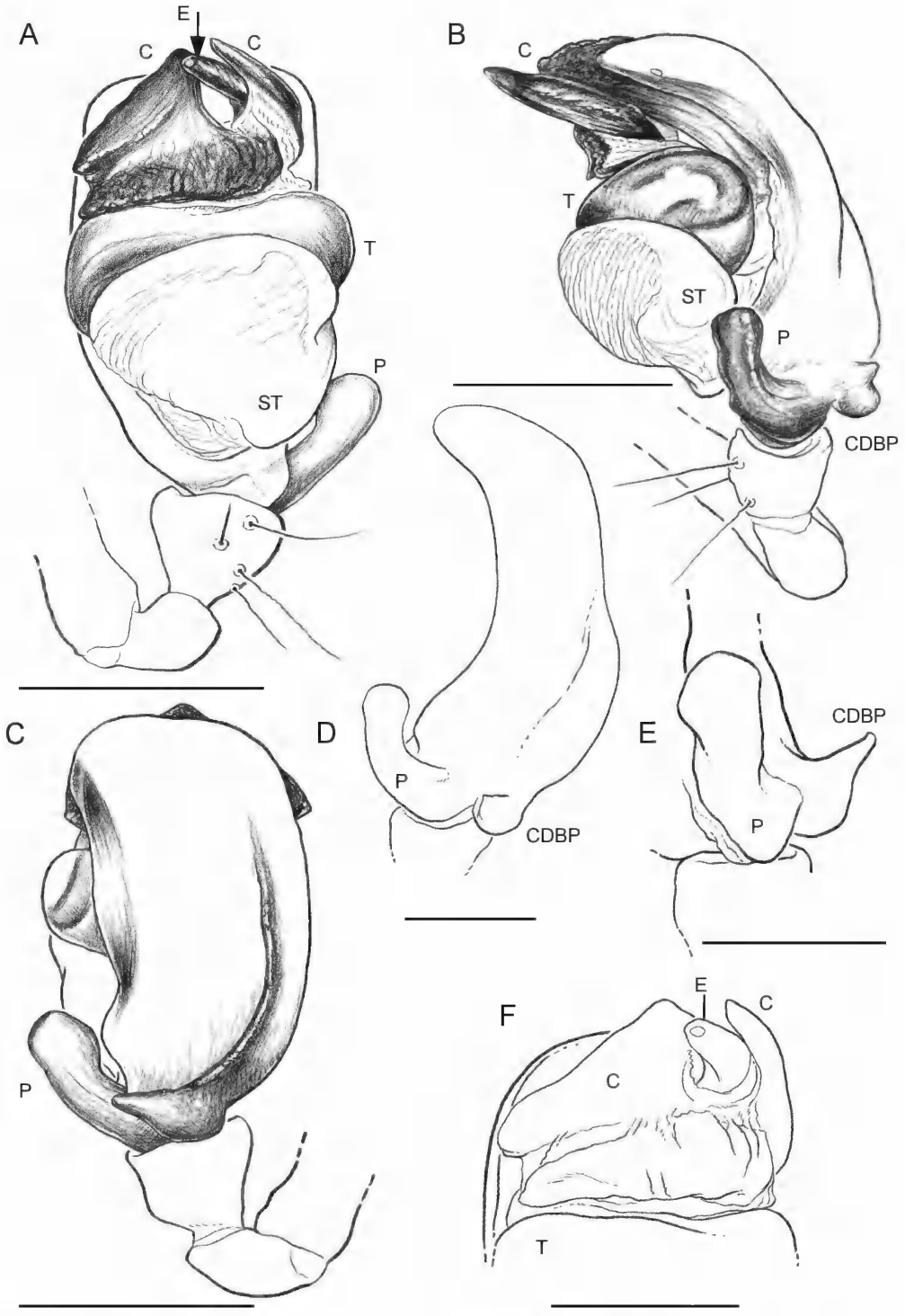

FIGURE 43. *Harlanethis weintrauborum* (KS 0503; TEAU016). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Pedipalp, ectodorsal. **E.** Pedipalp, CDBP detail. **F.** Conductor and embolus ventral detail. Scale bars: 0.5 mm.

spins. *Harlanethis* is an undeclinable proper name and feminine in gender.

DISTRIBUTION: This genus can be found in northeastern Queensland (fig. 60).

NATURAL HISTORY: *Harlanethis* appears to be endemic to the tropical northern zone of Queensland.

Harlanethis lipscombae, sp. nov.

Figures 39–42, 44, 60

TYPE MATERIAL: Female holotype from Queensland, Mt. Halifax, SE Ridge, 19° 7′ S, 146° 23′ E. 950 m. 19–21 March 1991, G.B. Monteith & D. Cook, Male allotype from NE Queensland, Millaa Millaa Falls, 17° 7″ S, 145° 36′ E. 834 m. 23–24 November 1994, G.B. Monteith. Both deposited at QM.

DIAGNOSIS: *Harlanethis lipscombae* is very similar to *H. weintrauborum*, but both sexes can be consistently distinguished from the latter species by details of the genitalia. In lateral view, the anterior margin of the triangular epigynal protrusion of *H. lipscombae* extends beyond the longitudinal grooves (figs. 39A, 44E), while in *H. weintrauborum* this anterior protrusion ends contiguous with the grooves' edges (figs. 39B, 44G). In lateral view, the dorsal cymbial ridge of *H. lipscombae* is more pronounced (figs. 40E, 42D) than that of *H. weintrauborum*, the basal conductor sclerite ectal margin is projected ventrally in *H. lipscombae* (figs. 40E, 42B), in contrast with the flat basal conductor sclerite present in *H. weintrauborum*, and basal cymbial apophysis tip more acute (fig. 42C, F) than its homolog in *H. weintrauborum* (fig. 43C, E), although in some specimens this last difference is very subtle.

DESCRIPTION: Female (TEAU019, TEAU037, TEAU038, TEAU048) total length 5.13. Cephalothorax length 1.67, width 1.38. Clypeus height 0.78 AME diameter. Ultrastructure of abdomen and spinnerets observed with SEM. Abdomen cuticle flat reticulated; all tracheae tubular, median tracheae restricted to abdomen, tracheal atrium glands absent. ALS with one major ampullate, one nubbin, ca. 60 piriform, tartipores numerous. PMS with one minor ampullate, one nubbin, and one cylindrical and three central aciniform spigots. PLS araneoid tripled clustered together at the base, aggregate and flagelliform tips separated, ca. 14 aciniform spigots distributed in two parallel rows, with two cylindrical gland spigots at the periphery. Femur I length 2.96. Femora III and IV with ca. six prolateral trichobothria, distributed at the base, flagellum smooth. Spermathecae membranous (figs. 39E, 44C), internal surfaces covered with accessory gland ducts, duct bases acorn shaped (fig. 41E).

Male same as female except as noted. Total length 3.86. Cephalothorax length 1.71, width 1.35. Carapace dorsal coloration white to pale yellow. Clypeus 0.83 AME diameter, pale yellow. Sternum pale yellow. Femur I length 3.65. Right pedipalp expanded. Basal hematodocha highly expanded, bulb sclerites connected by membranous attachments that moved only slightly. Conductor attachment to the tegulum membranous. Conductor divided in three sclerites united by membranous joints (fig. 42E, G). The most basal conductor sclerite is roughly rectangular, with the other conductor sclerites originating at its apical surface. Apical conductor sclerites are lamelliform and longer than wide (figs. 39G, H, 42A, B). These two sclerites flank the embolus in unexpanded palps (figs. 41B, C, 43F), but this configuration changes after expansion freeing the embolus from this grove (fig. 42G). Description based on specimen (TEAU038).

VARIATION: Females ($N = 2$) total length 4.77–5.13, cephalothorax length 1.67–1.78, width 1.31–1.38. The size of the triangular protrusion and the separation between the longitudinal grooves vary as observed in ventral view. The shape of the dorsal basal process tip varies from sharper to more blunt.

ETYMOLOGY: This species is named by the third author (G.H.) to honor protist systematist Diana Lipscomb, colleague and friend of the authors.

DISTRIBUTION: This species can be found in northeast Queensland, south of Cairns (fig. 60A).

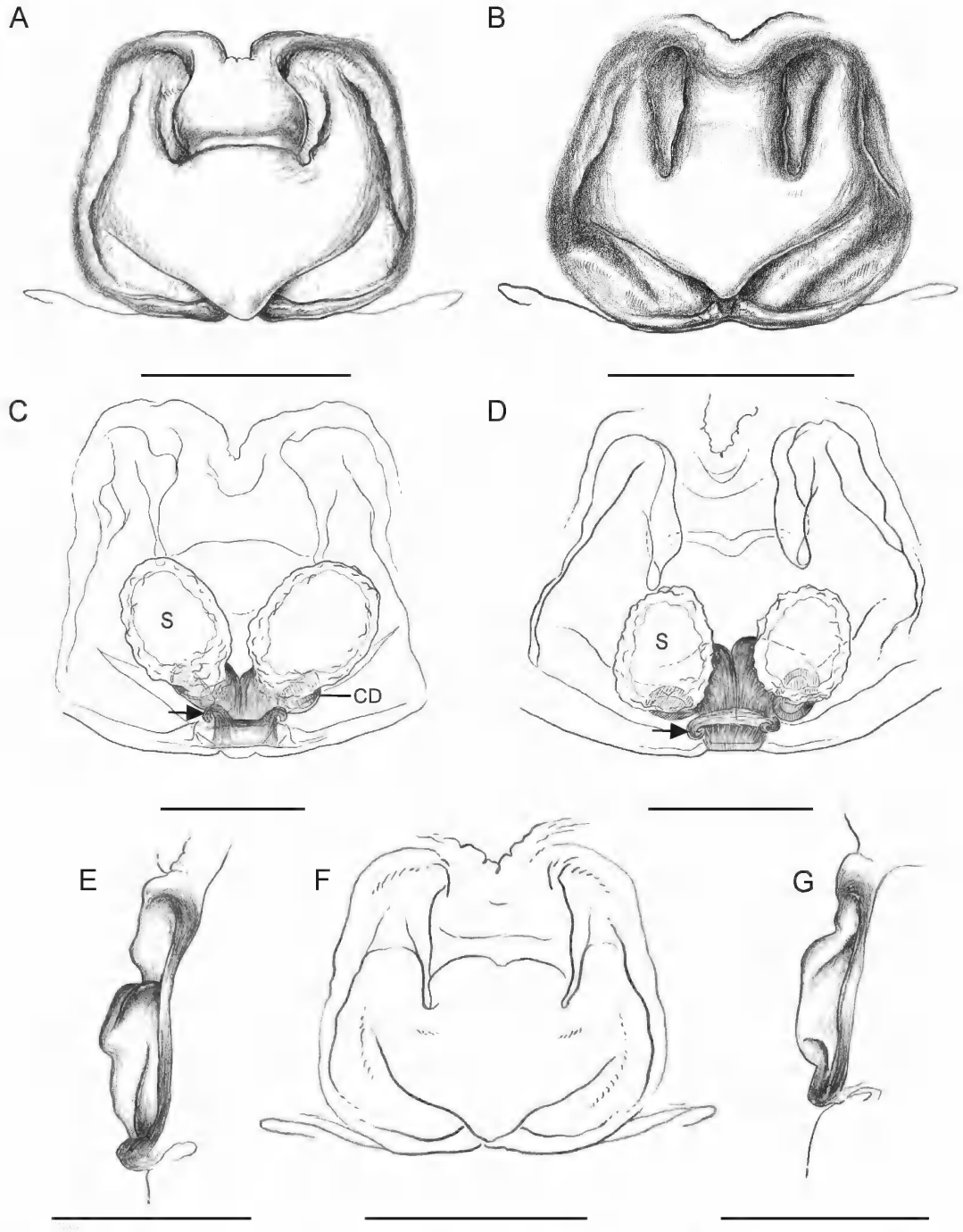

FIGURE 44. *Harlanethis* epigynum illustrations (TEAU037; TEAU050). **A.** *H. lipscombae*, ventral. **B.** *H. weintrauborum*, ventral. **C.** *H. lipscombae*, dorsal. **D.** *H. weintrauborum*, dorsal. **E.** *H. lipscombae*, lateral. **F.** *H. lipscombae*, ventral. **G.** *H. weintrauborum*, lateral. Scale bars: 0.5 mm.

MATERIAL EXAMINED: $N = 17$. AUSTRALIA: Queensland; Atherton Tablelands, Rose Gums Wilderness Retreat, waterfall trail, 17° 18′ 51.1″ S, 145° 42′ 8.6″ E, 770 m, G. Hormiga, L. Lopardo, 15–17 March 2006, rainforest around waterfall, 1 female (measurement voucher FAPM003) GWU; Crater Lakes National Park, Lake Barrine, 17° 14′ 41.5″ S, 145° 38′ 31″ E, 808 m, G. Hormiga, N. Scharff, J. Pedersen, 9–10 February 2012, Rainforest Walk Trail, night collection, 1 female, GWU GH1144; Bellenden Ker Range, 1/2 km S Cable Tower No 7, 17° 14′ 38.23″ S, 145° 53′ 31.69″ E, 500 m, 1–7 November 1981, 1 female 2 immatures, QM S27772; Danbulla State Forest, Robson Creek Rd., 2 km N by road from Danbulla Forest Drive, 17° 7′ S, 145° 37′ E 836 m. G. Milledge, 25 April 1998, rainforest, 2 males, 1 female (1 male image and SEM voucher TEAU038, right palp expanded left used for SEM) AM KS52425; Millaa Millaa Falls, 17° 30′ S, 145° 36′ E, 834 m. G.B. Monteith, 23-24 November 1994, 1 male Allotype, 3 females (2 used for SEM voucher TEAU037) QM S32487; Millaa Millaa Falls, 17° 30′ S, 145° 36′ E, 834 m. G.B. Monteith, 16 May 1995 1 female QM S38095; Mt Fisher Kjellberg Rd., 17° 32″ S, 145° 33″ E, 1100 m. G.B. Monteith, 17–18 May 1995, 2 females (1 used for cleared epigynum voucher TEAU019) QM S43944. Mt. Halifax SE Ridge, 19° 7′ 12″ S, 146° 13′ 48″ E, 950 m. G. Monteith & D. Cook, 19–21 March 1991 1 female Holotype QM S17955. Mt. Williams Summit, 16° 55′ S, 145° 40′ E, 1000 m, G. Monteith & D. Cook, 27–28 November 1997, 1 female (image and description voucher TEAU048) QM S41804.

Harlanethis weintrauborum, sp. nov.

Figures 38–40, 43–44, 60

TYPE MATERIAL: Female holotype (AM KS129856) and male allotype (AM KS129856) from Queensland, Thornton Peak, North of Daintree, 16° 10′ S, 145° 22′ E, 610 m. M. Gray, November 1975, rainforest site 39 (AM). Deposited at AM.

DIAGNOSIS: Females of *H. weintrauborum*, can be distinguished from *H. lipscombae* by the absence of the triangular anterior margin protrusion as observed in lateral view (fig. 39B). In males of *H. weintrauborum* the dorsal cymbial ridge, in lateral view, is less pronounced than that of *H. lipscombae* (figs. 40F, 43D), the basal conductor sclerite ectal margin is flat (figs. 40F, 43B), in contrast to the projected conductor ectal margin found in *H. lipscombae*, and basal cymbial apophysis tip blunt (fig. 43E), in contrast to the acute tip found in *H. lipscombae*.

DESCRIPTION: Female (TEAU017, TEAU050) total length 4.91. Cephalothorax length 1.87, width 1.38. Clypeus height 0.80 AME diameter. Femur I length 3.66. Cephalothorax dark yellow, sternum light brown. Ultrastructure not examined with SEM. Epigynum as in figures: 39B, D, F; 44B, D, G.

Male (TEAU016) as female except as noted. Total length 4.15. Cephalothorax length 1.76, width 1.50. Clypeus 0.91 AME diameter. Femur I length 3.65. Palp as in figures: 40B, D, F, H; 43A–F.

VARIATION: Females ($N = 2$) total length 4.00–4.91, cephalothorax length 1.72–1.89, width 1.30–1.31. The size of the triangular epigynal protrusion and the separation between the longitudinal grooves varies (this is best observed in ventral view).

ETYMOLOGY: This species is named by the third author (G.H.) to honor Robert L. and Frances Weintraub, whose endowment to the Department of Biological Sciences at the George Washington University for the study of systematics has led to the discovery of myriad spiders.

DISTRIBUTION: This species can be found in northeastern Queensland, southwest of Cape Tribulation (fig. 60A).

MATERIAL EXAMINED: $N = 25$. AUSTRALIA: Queensland, East Normanby R, 15° 53′ S, 145° 12′ E, 540 m, 31 December 1990, 1 female, QM S25115; Mt. Boolbun South, 15° 57′ S, 145° 8′ E, 850-1000 m, Monteith, Cook & Rob-

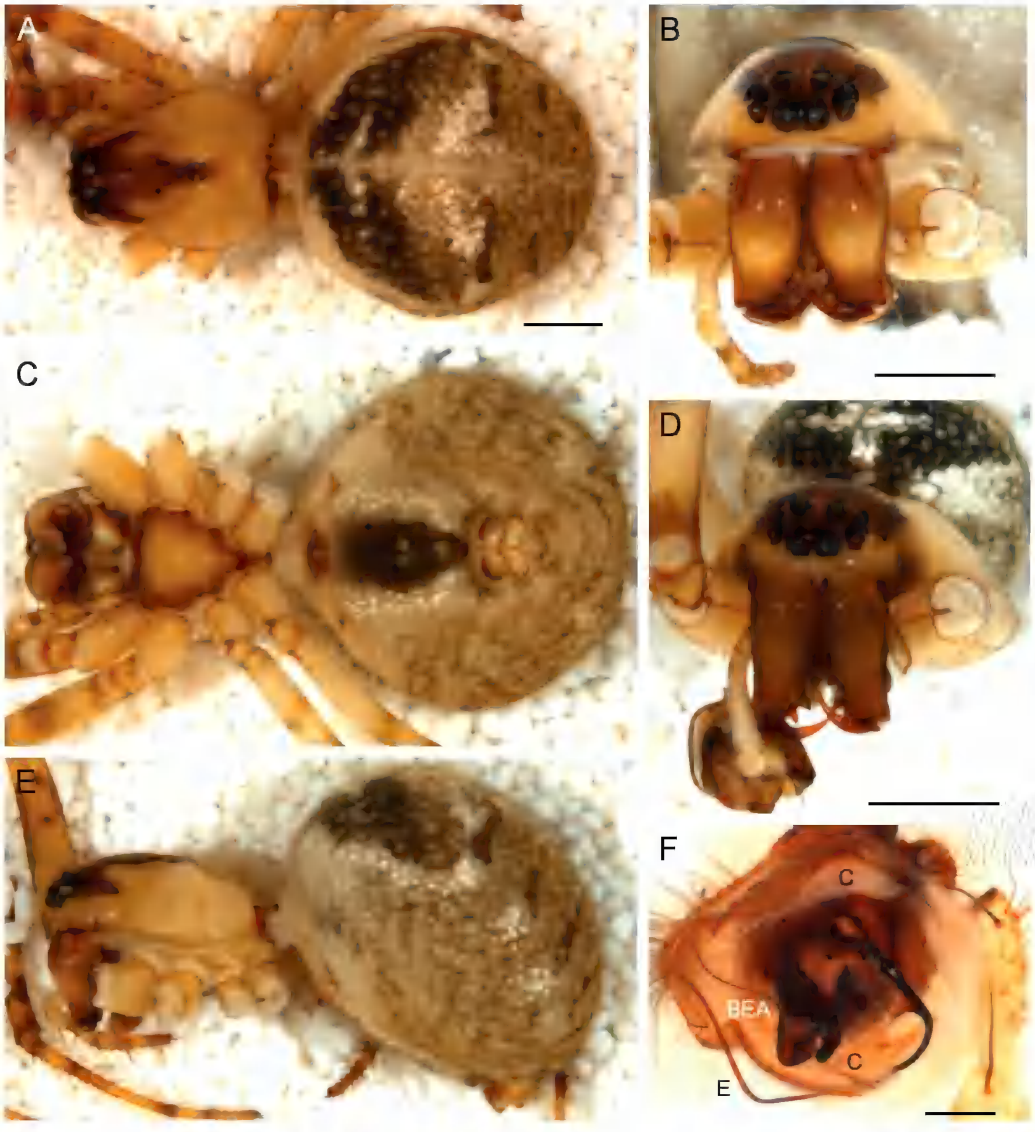

FIGURE 45. *Taraire rufolineata* (TEAU029; **A–E**) and *T. oculta* (TEAU042; **F**). **A.** Female, dorsal habitus. **B.** Female, frontal habitus. **C.** Female, ventral habitus. **D.** Male, frontal habitus. **E.** Female, lateral habitus. **F.** Pedipalp, apical (expanded). Scale bars: A–D, 1.0 mm; F, 0.2 mm.

erts, 4–6 November 1995, 1 female, QM S31752; Mt. Boolbun South, 15° 57′ S, 145° 8′ E, 850-1000 m, Monteith, Cook & Roberts, 4–6 November 1995, 2 females S41030; Thornton Peak, North of Daintree, N. 16° 10′ S, 145° 22′ E, 610 m, M. Gray, November 1975, rainforest site 39, 1 male, 6 females, 10 immatures (1 female image voucher TEAU016, 1 epigynum cleared voucher TEAU050, 1 male image voucher TEAU017, type specimens extracted from this series); female holotype and male allotype extracted from this specimen series) AM KS129856; Windsor Tableland, Barracks, 16° 16′ S, 145° 3′ E, 1060 m. Monteith, Cook & Burwell, 23–24 November 1997, 1 male, QM S43978.

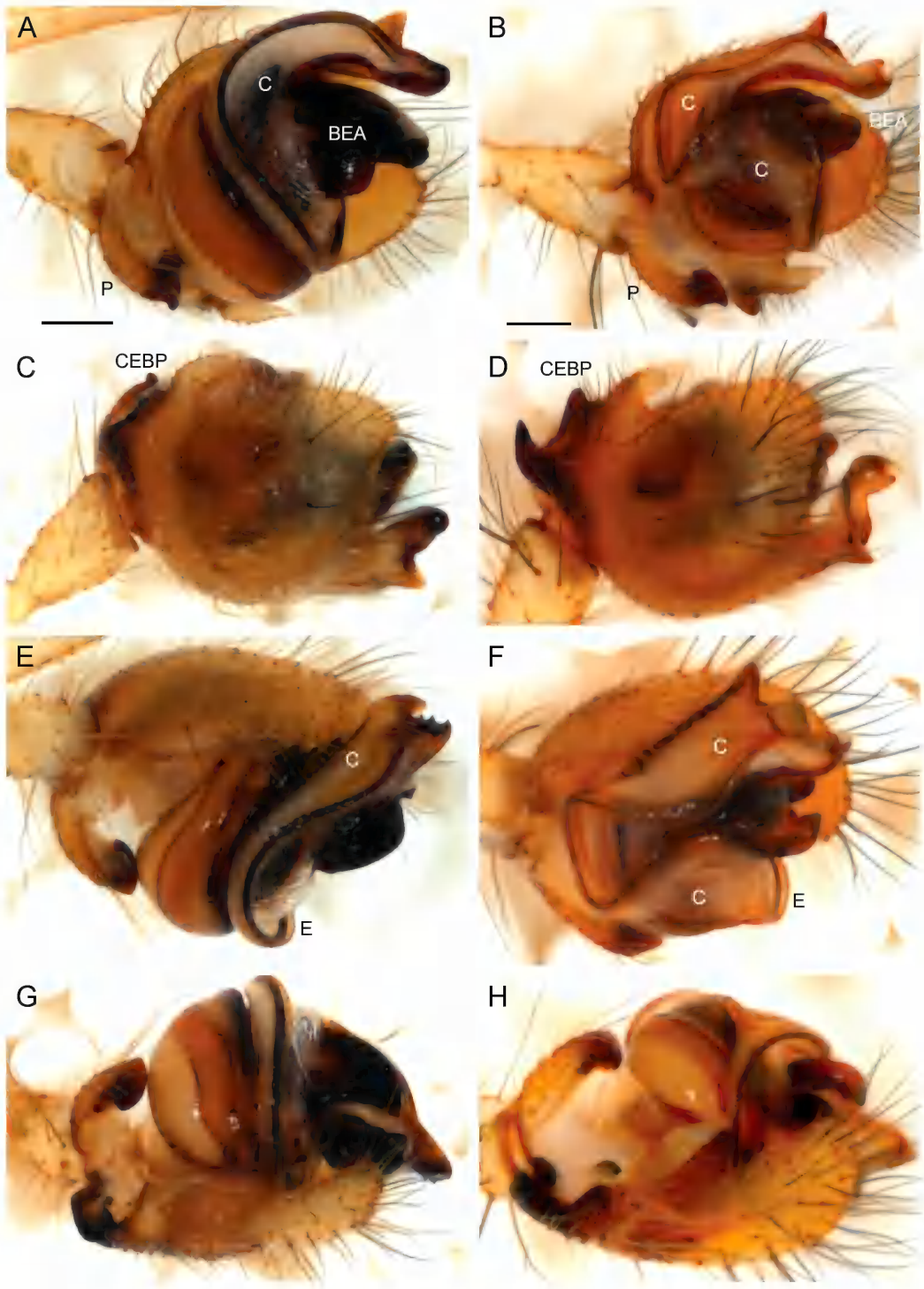

FIGURE 46. *Taraire rufolineata* (TEAU030; **A, C, E, G**) and *T. oculta* (TEAU032; **B, D, F, H**), pedipalps. **A, B.** Ventral. **C, D.** Dorsal. **E, F.** Mesal. **G, H.** Ectal. Scale bars: 0.2 mm.

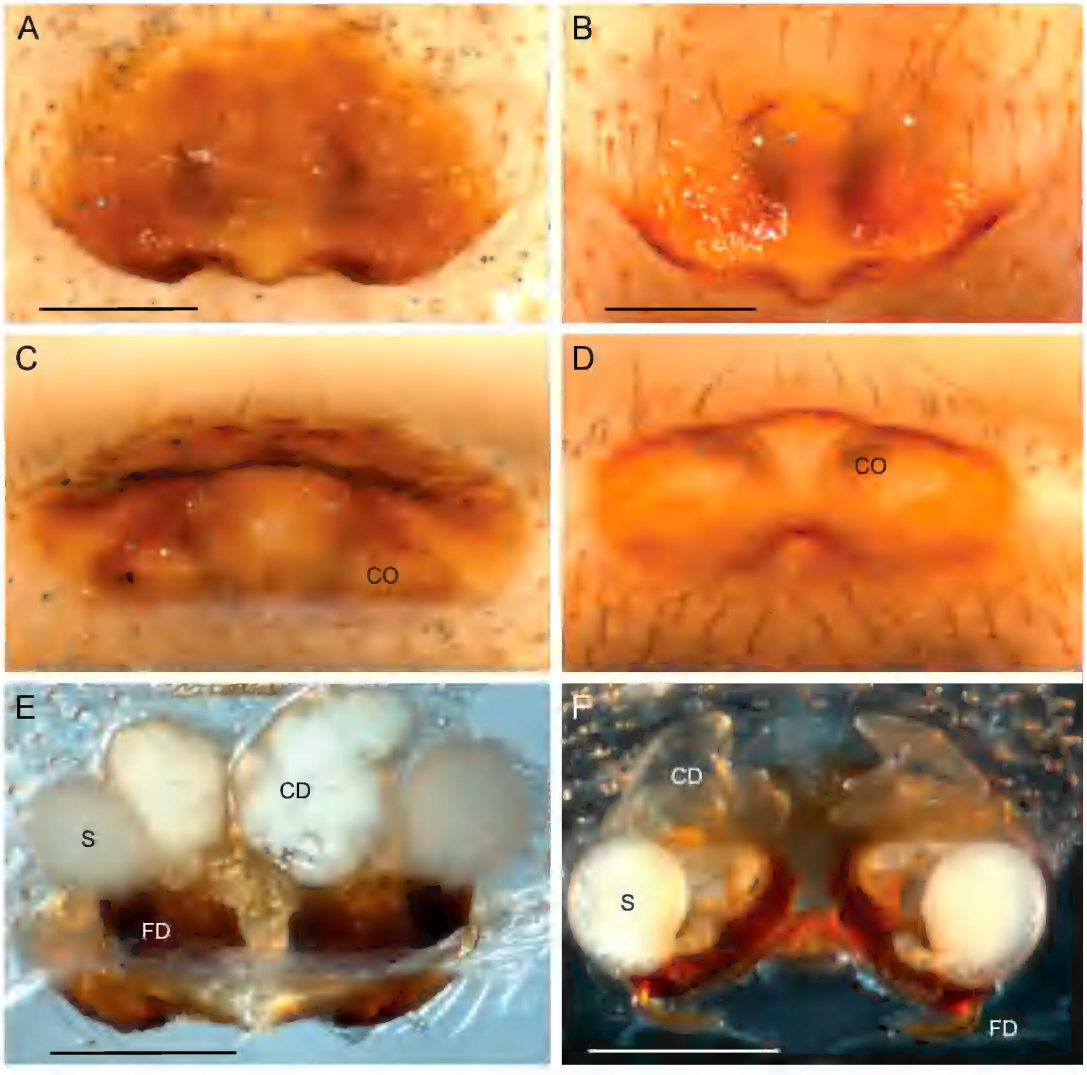

FIGURE 47. *Taraire rufolineata* (TEAU029; **A, C, E**) and *T. oculta* (TEAU031; **B, D, F**), epigyna. **A, B.** Ventral. **C, D.** Caudal. **E, F.** Dorsal digested. Scale bars: 0.2 mm.

INCERTAE SUBFAMILIAE

Genus ***Taraire,*** gen. nov.

Figures 45–50, 55

Type species: *Linyphia rufolineata* Urquhart, 1889.

DIAGNOSIS: *Taraire* species resemble the large species of *Nanometa* in their internal female reproductive anatomy (fig. 48C, D), and the monotypic *Tawhai* by the projected epigynal plate (figs. 47A, B, 51D) and male cymbial processes (figs. 46A–H, 52A–D). However, *Taraire* females can be consistently separated from *Nanometa* by having the posterior edge of the epigynum extending below the epigastric furrow (fig. 47A, B). *Tawhai arborea* differs from *Taraire* species in that the former genus has a protruded epigynum with short and sclerotized copulatory ducts (figs. 51H, 54F); in *Taraire* the copulatory ducts are much longer (fig. 49E) and inside membranous sacks (fig. 47E, F). Males of *Taraire*

can be separated from those of *Nanometa* by the presence of one large heavily sclerotized embolic apophysis attached to the embolic base through a membrane (figs. 45F, 46A, B, 49A–C, 50A–C). In *Taraire* the tegulum is basally displaced and cup shaped (figs. 46A, B, 49A, B, 50A, B), unlike the donut-shaped and dorsoventrally compressed tegulum of *Nanometa* (figs. 10C, F, 13A, B). *Taraire* species lack the booklung plate stridulatory organs found in *Nanometa*. In *Taraire* the conductor is considerably larger than the embolic apophysis and completely encloses a filiform embolus (fig. 45F), while in *Tawhai* the conductor is small and rectangular in shape, and partially enclosing a thicker embolus (fig. 52A, C).

DESCRIPTION: Female total length 4.95–5.57. Cephalothorax length 2.35–2.87, width 1.85–2.27. Carapace glabrous, pale yellow or yellow, dark brown only over the cephalic region. Fovea deep, transversal, carapace dorsal pits absent (fig. 45A). Clypeus height 0.9 to 1.3 AME diameter, cuticle darker around the eyes and over the cheliceral boss (fig. 45B). Anterior eyes slightly larger than posterior eyes. Lateral eyes on the same tubercle, one AME diameter apart from median eyes and approximately half that size. Chelicerae with few scattered setae, cuticle smooth (fig. 45B), with three pro- and two retromarginal teeth, with ca. two cheliceral denticles. Endites longer than wide, dark brown, internal margins pale yellow. Labium rectangular, wider than long, colored as the endites. Sternum pale yellow to yellow, trapezoidal in shape, wider between the first two legs (fig. 45C). Abdomen dorsum: background pale to dark gray, white guanine patches concentrated on two anterior spots, anterior margin covered by a wide dark-brown band of patches, that continues posteriorly as three to four dark-brown chevrons (fig. 45A). Ventral surface with median dark-brown longitudinal line, flanked by two lines of guanine white patches (fig. 45C). Lateral sides with a reticulated pattern of guanine and dark-brown patches (fig. 45E). Booklung covers without stridulatory striae. Spinnerets pale yellow to brown, lighter pattern on internal surfaces. Ultrastructure of abdomen and spinnerets observed with SEM. Abdomen cuticle flat reticulated, all tracheae tube shaped, median tracheae with leaf-shaped tips. ALS with one major ampullate, one nubbin, ca. 70 piriform, tartipores numerous. PMS with one minor ampullate, one nubbin, and one cylindrical and three central aciniform spigots. PLS araneoid triplet separated at the base and tips, ca. 12 aciniform spigots distributed in two parallel rows, two cylindrical gland spigots at periphery. Leg formula 1-2-4-3. Femur I length 3.23–3.79. First pair considerably larger. Background of all legs yellow to dark yellow and covered with dark-brown annuli. Femora without trichobothria, few setae present, other segments hirsute, increasing after tibiae. Epigynum: rectangular shape, wider than long. Copulatory openings located on the posterior margin (figs. 47C, D, 48A, B). Internal epigynal structures similar to those found in *Nanometa*. Copulatory ducts modified as membranous sacs and separated from the spermathecae giving the appearance of four receptacles (fig. 48C, D). Accessory duct glands clustered on puffball-shaped clusters. Fertilization ducts short, straight (figs. 49E, 50E).

Male same as female except as noted. Total length 4.81–5.73. Cephalothorax length 2.47–2.59, width 1.99–2.15. Clypeus height 0.64–0.95 AME diameter (fig. 45D). Chelicerae darker than female, slightly longer and narrower, dorsal cuticle rugose (fig. 45D). Abdominal pattern as in female, but lighter. Femur I length 4.43–5.58. Pedipalpal tibia triangular, 1.3 times longer than wide, apical margin wider. CEBP short and heavily sclerotized cuticular ridge, with or without spines (figs. 46B, 49A, 50A), CEMP spine shaped, long and completely separated from the cymbium (fig. 48E, F). Paracymbium finger shaped and hirsute (figs. 46G, H). Tegulum basally displaced and cup shaped (figs. 49A, B). Conductor margins sclerotized, central part membranous (it did not expand with lactic acid), completely covering the embolus and variable in shape between

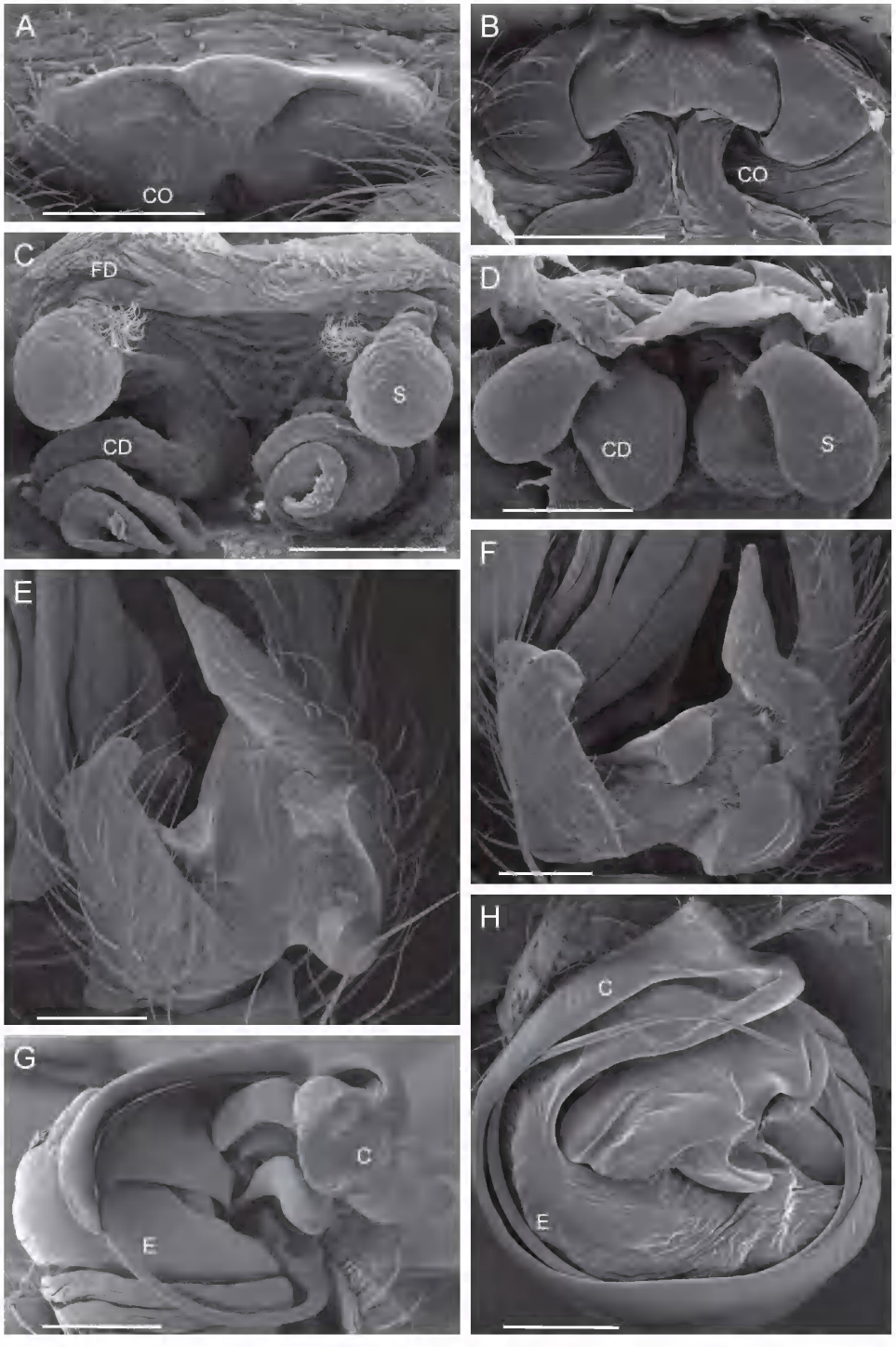

FIGURE 48. *Taraire oculta* (TEAU042; **A, C, E, G**) and *T. rufolineata* (female: TEAU043; male: TEAU046; **B, D, F, H**). **A, B.** Epigynum, caudal. **C, D.** Epigynum, dorsal. **E, F.** CEBP and CEMP, detail. **G, H.** Conductor and embolus apical detail. Scale bars: 0.2 mm.

species (figs. 49A–C, 50A–C). Embolus long, filiform, and flexible. Embolus basal apophysis attachment membranous, basal apophysis heavily sclerotized and formed by one sclerite partially divided by a membrane (figs. 45F, 49B).

COMPOSITION: *Taraire rufolineata* and *Taraire oculta*.

SYSTEMATICS: *Taraire* is sister to *Tawhai* (figs. 61–63), but the placement of the lineage including these two genera is unstable across phylogenetic analyses. Putative morphological synapomorphies supporting the monophyly of *Taraire* include the apically acute, digitiform CEMP pointing anteriorly (figs. 46D, 49C), the narrowing of the conductor margin (which encloses the filiform embolus), as seen in ventral view (figs. 46A, B, 49A, 50A), and sclerotized, horizontal fertilization ducts (figs. 47E, F, 49E, 50E).

ETYMOLOGY: The genus is named after the Māori word for the New Zealand endemic tree *Beilschmiedia tarairi* A. Cunnimgham (Lauraceae). *Taraire* is indeclinable and feminine in gender.

DISTRIBUTION: *Taraire* is found on the North, South and Stewart islands of New Zealand (fig. 55).

NATURAL HISTORY: *Taraire* builds vertical orb webs. They rest at the central hub with two legs forward and the fourth pair pointed back (fig. 3A, B). The webs can be located near the forest floor, such as under rock shelves (G.H. and R.K., personal obs.).

Taraire rufolineata (Urquhart, 1889), comb. nov.

Figures 4, 45–50, 55

Linyphia rufo-lineata Urquhart, 1889: 137 (male and female syntypes).

Landana lautiuscula Dalmas, 1917: 372, figs. 40–43 (female description). Two female syntypes (from Murchison, South Island), MNHN, examined. Synonymized by Bryant (1933), although Dalmas' syntypes were not examined by her.

Meta rufolineata (Urquart, 1889) Bryant, 1933: 21. Transferred from *Landana* to *Meta*.

TYPE MATERIAL: Syntypes (2 males, 3 females, 1 juvenile) from the North Island of New Zealand, summit of Te Aroha, deposited at the Canterbury Museum (A1367). The syntypes have been examined by Cor Vink (in litt., G.H.) to confirm the identification.

DIAGNOSIS: *Taraire rufolineata* can be differentiated from *T. oculta* by the median projection of the epigynum, which does not extend beyond the distal margin (fig. 47A); this median projection does extend beyond that margin in the latter species (fig. 47B). The epigynal median plate of *T. rufolineata* is triangular, almost the same width as the epigynum and copulatory openings directed toward the epigynum lateral margins (figs. 47C, 48B); this plate is considerably narrower and with the copulatory openings directed to the sagittal plane in *T. oculta* (fig. 47D). The conductor of *T. rufolineata* has a distal portion bent apically and its basal part is continuous with the tegulum (figs. 46A, 48H, 49A), whereas *T. oculta* has a conductor with both portions bent (fig. 46B). The embolus basal apophysis not covered by conductor and its complex shape is also diagnostic for *T. rufolineata* (figs. 46A, 49B): in addition, the CEBP lacks spines (figs. 48F, 49C), while *T. oculta* bears one spine on this process (figs. 48E, 50C).

DESCRIPTION: Female (TEAU029, TEAU043) total length 6.6. Cephalothorax length 2.5, width 2.1. Clypeus height 0.9 AME diameter. Cheliceral promargin and retromargin with three and two teeth respectively, with ca. two cheliceral denticles. Femur I length 3.6. Copulatory ducts modified as membranous sacs with smooth cuticle (figs. 47E, 49E), spermathecae round and slightly more sclerotized that the "copulatory sacs" (fig. 47E), accessory duct glands clustered on puffball-shaped clusters (figs. 48C, 49E).

Male (TEAU030, TEAU046) same as female except as noted. Total length 8.2. Cephalothorax length 4.4, width 3.3. Clypeus 0.6 AME diameter (fig. 45D). Cephalothorax and abdomen lighter than female. Femur I length 8.9. Embolic apophysis formed by a heavily sclerotized curved lamella with a membranous center (fig. 46A, E, G).

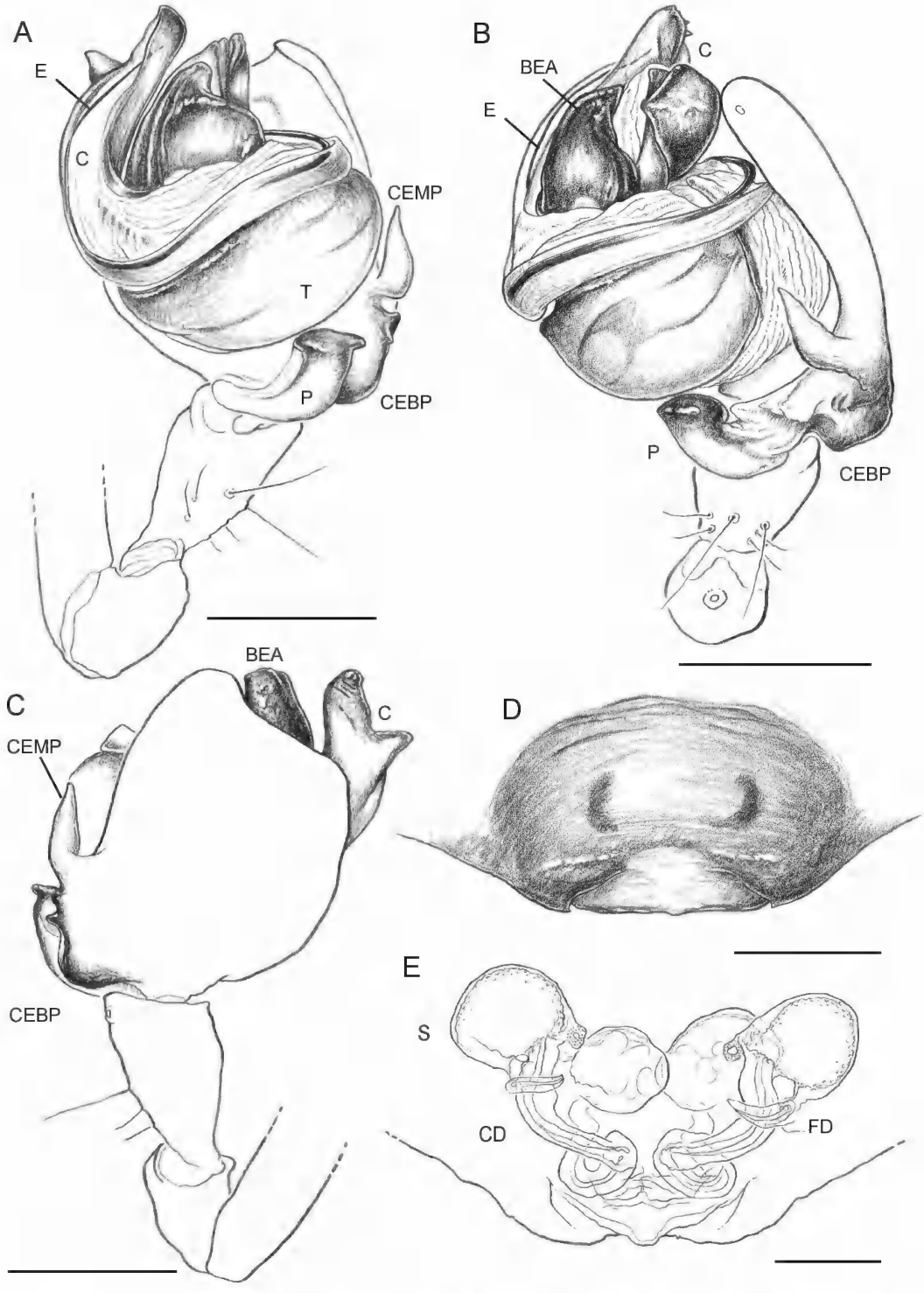

FIGURE 49. *Taraire rufolineata* (male: TEAU030; female: TEAU043). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–C, 0.5 mm; D, E, 0.2 mm.

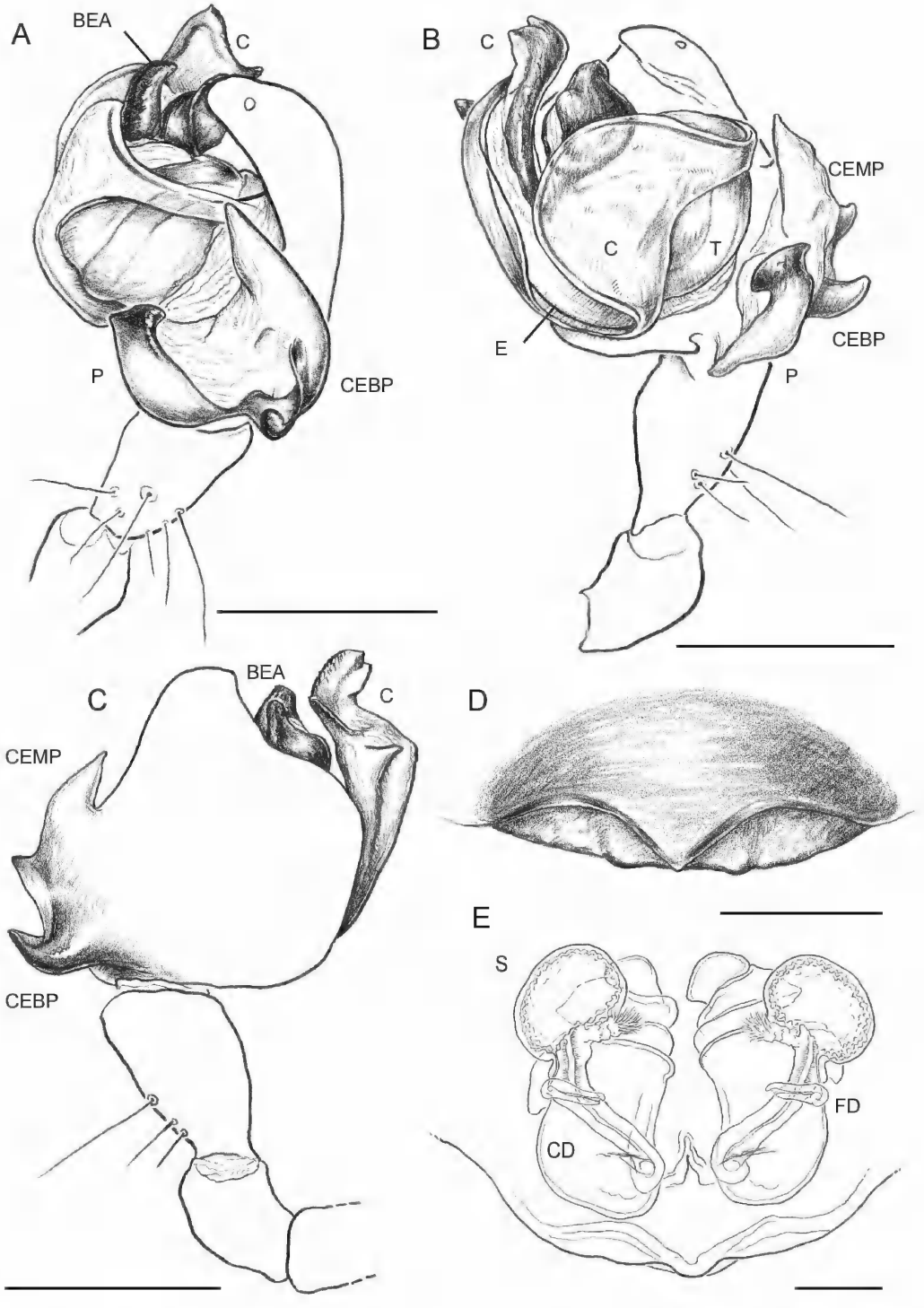

FIGURE 50. *Taraire oculta* (male: QM S58330; female: TEAU042). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, dorsal. Scale bars: A–C, 0.5 mm; D, 0.2 mm; E, 0.1 mm.

VARIATION: Females ($N = 3$) total length 4.95–6.58, cephalothorax length 2.35–2.52, width 1.85–2.05.

DISTRIBUTION: *Taraire rufolineata* is found around the area of Arthur's Pass in the central region of the South Island of New Zealand (fig. 55). The syntypes were collected at the summit of Mount Te Aroha (952 m), the highest point on the Kaimai-Mamaku range, but so far this is the only record of this species from the North Island.

NATURAL HISTORY: *Taraire rufolineata* builds vertical orb webs in forested areas, with an open hub centrally located. They rest at the central hub with two legs forward and the fourth pair pointed back (fig. 4A).

MATERIAL EXAMINED: $N = 9$. NEW ZEALAND, South Island, Arthur's Pass National Park, Bridal Veil Track, 42° 55′ 49.6″ S, 171° 33′ 43.4″ E, 819 m. G. Hormiga, N. Scharff, J. Pedersen, 4–5 February 2012, 1 male, 1 female (DNA voucher GH1136) GWU; 1 female (G. Hormiga field image photos 7979–7983/4.ii.2012GH) GWU; 1 female (G. Hormiga field image photos 7984–7988/4.ii.2012GH) GWU; 23 females, 4 immatures (image voucher TEAU043) GWU; Bealey Vy Tr., 42° 56′ 1.75″ S, 171° 33′ 29.65″ E, 840 m. A. Newton & M. Thayer 18–21 March 1980, Subalpine *Nothofagus*, *Nothofagus solandri* bark pyrethrin fogging 1 female AMNH; Selwyn Dist. Co., Bridal Veil Falls Track, 42° 56′ 1.3″ S, 171° 33′ 47.7″ E, 789 m. G. Hormiga, N. Scharff, 4 March 2010, leaf litter, moss, & general collecting at night, 1 female (image voucher TEAU029) GWU; 1 male (image voucher TEAU030) GWU; 1 male, 4 females, 4 immatures (image voucher TEAU046) GWU.

Taraire oculta, sp. nov.

Figures 4–5, 45–48, 50, 55

TYPE MATERIAL: Male holotype and female allotype from New Zealand, South Island, Fox Glacier, Westland Tai Poutini National Park, Glacier View Road, Chalet Lookout Walk, 43° 29′ 45.5″ S, 170° 1′ 54.8″ E, 297 m., G. Hormiga, N. Scharff, J. Pedersen, 2 February 2012, night collecting (DNA series voucher GH1133), deposited at MONZ.

DIAGNOSIS: In *Taraire oculta*, the epigynum median projection extends beyond its posterior margin (fig. 47B), while in *T. rufolineata* this projection does not exceed this margin (fig. 47A). The epigynal median plate of *T. oculta* is conical, narrow (ca. 1/4 width of epigynum), and the copulatory openings are directed to the sagittal plane (figs. 47D, 48A), whereas in *T. rufolineata* it is triangular, almost the same width as the epigynum, and the copulatory openings are directed toward the epigynum lateral margins (fig. 47C). In *T. oculta* the conductor basal and distal portions bend apically and hide most of the embolic apophysis (figs. 46B, 48G, 50B); in *T. rufolineata* only the distal portion of the conductor is bent and the embolus basal apophysis is completely visible in ventral view (figs.46A, 49A). The CEBP has one heavily sclerotized spine (figs. 46D, 48E, 50A–C) that is absent in *T. rufolineata*.

DESCRIPTION: Female (TEAU031, TEAU042) total length 7.6. Cephalothorax length 2.9, width 2.3. Clypeus height 0.9 AME diameter. Chelicera promargin and retromargin with three and two teeth respectively, cheliceral denticles absent. Femur I length 3.8. Copulatory ducts modified as membranous sacs shaped as wizard hats with smooth cuticle (figs. 47F, 50E), spermathecae round and slightly more sclerotized than the "copulatory sacs," accessory duct glands clustered on puffball-shaped clusters (figs. 47F, 48C, 50E).

Male (TEAU032, TEAU042) same as female except as noted. Total length 5.7. Cephalothorax length 2.6, width 2.1. Clypeus 0.6 AME diameter. Cephalothorax and abdomen coloration lighter than in female. Femur I length 4.7. Expanded palp: basal hematodocha largely distended and responsible for most of the movements, embolic division considerably less expansible; conductor membranous section mobile but not expanded. Embolus-tegulum membrane present, embolus filiform and completely unlocked from conductor (fig. 45F). Embolic apophysis attachment

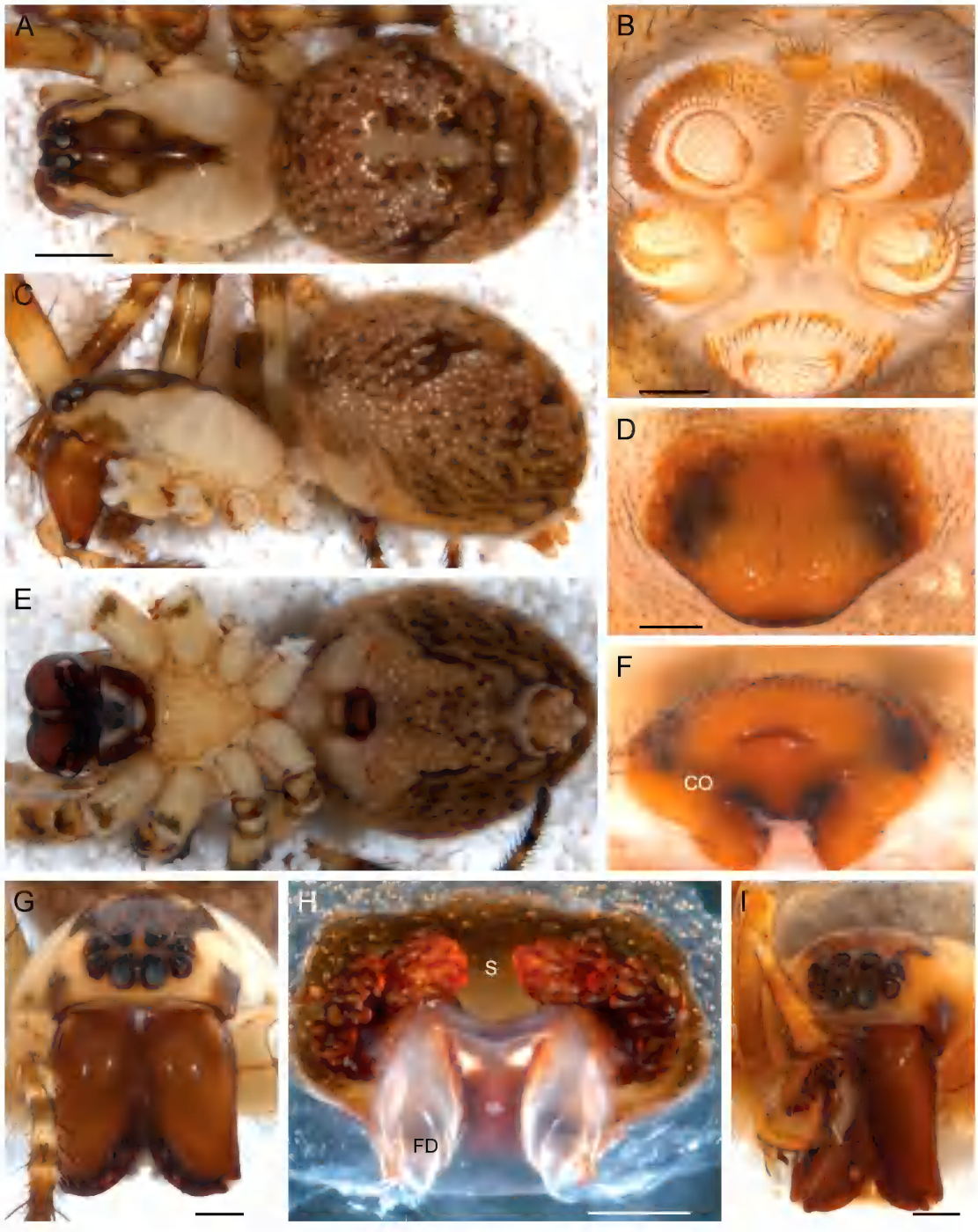

FIGURE 51. *Tawhai arborea* (female: TEAU026; male: TEAU028). **A.** Female, dorsal habitus. **B.** Female, spinning apparatus. **C.** Female, lateral habitus. **D.** Epigynum, ventral. **E.** Female, ventral habitus. **F.** Epigynum, caudal. **G.** Female, frontal habitus. **H.** Epigynum, apical digested. **I.** Male, frontal habitus. Scale bars: A–C, E, 1.0 mm; B, D, F, H, 0.2 mm; G, I, 0.5 mm.

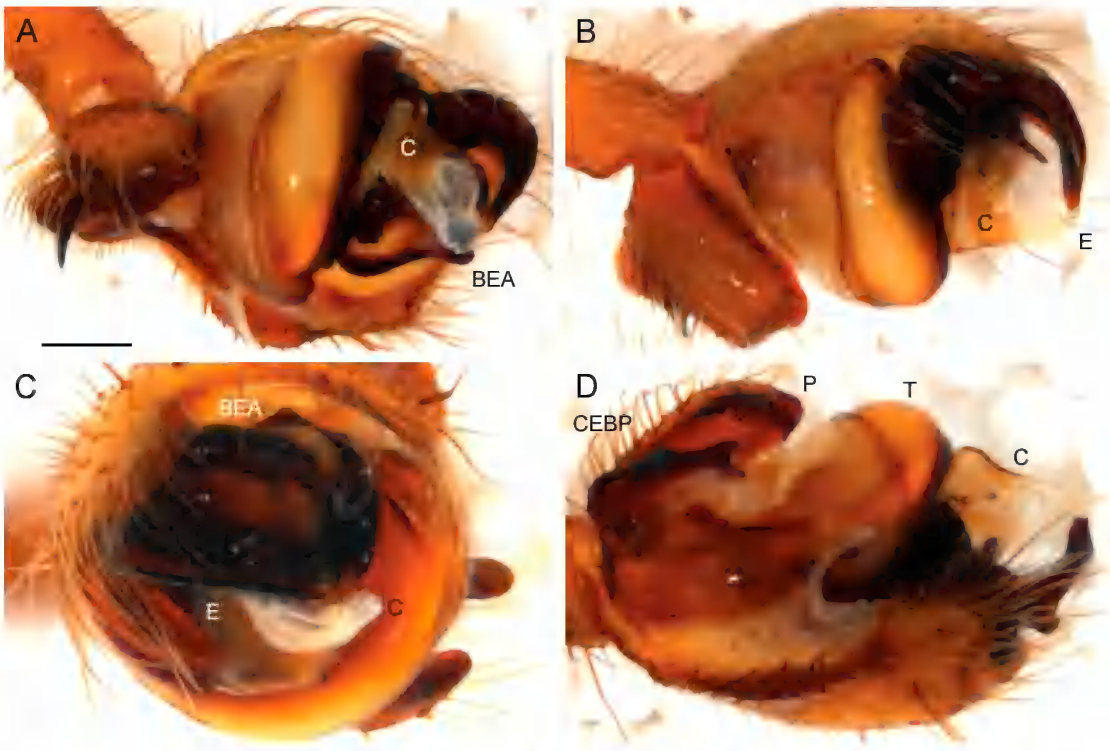

FIGURE 52. *Tawhai arborea*, pedipalp (TEAU028). **A.** Ventral. **B.** Mesal. **C.** Apical. **D.** Ectal. Scale bars: 0.5 mm.

membranous, apophysis formed by a heavily sclerotized curved lamella with a membranous center (figs. 45F, 46B, 50A).

VARIATION: Females ($N = 3$) total length 5.36–7.61, cephalothorax length 2.46–2.67, width 1.87–2.18. Males ($N = 2$) total length 4.81–5.73, cephalothorax length 2.47–2.59, width 1.99–2.07.

ETYMOLOGY: The species epithet is taken from the Spanish word for "hidden," *oculto*, in reference the embolic apophysis hidden by a conductor fold, which is a diagnostic feature of this species.

DISTRIBUTION: This species is found in the South Island of New Zealand (fig. 55).

NATURAL HISTORY: *Taraire oculta* builds vertical orb webs with an open hub ($n = 10$). The webs are often located near the forest floor, in areas such as under rock shelves. There is variation in in the hub placement, central some webs but in the upper part of the web in the webs of some juveniles (but not all).

MATERIAL EXAMINED: $N = 14$. NEW ZEALAND, South Island, Fox Glacier, National Park Westland Tai Poutini, Glacier View Road, Chalet Lookout Walk, 43° 29′ 45.5″ S, 170° 1′ 54.8″ E, 297 m. G. Hormiga, N. Scharff, J. Pedersen, 2 February 2012, night collecting, 2 females, behavior voucher GWU; 1 female (image voucher TEAU031) GWU; 1 male (image voucher TEAU032) GWU; 4 males, 14 females (image voucher TEAU042) GWU; 2 males, 12 females (DNA series voucher GH1133) GWU; 3 females, 1 immature (DNA series voucher GH1133) GWU; 1 male, 1 female (G. Hormiga field image photos DSC_7902-7910) GWU; 1 female (field image voucher photos 7915–7919/2.ii.2012GH) GWU; 1 female (field image voucher photos 7930–7940/2.ii.2012GH) GWU; 1 female (field image voucher photos 7941–7945) GWU;

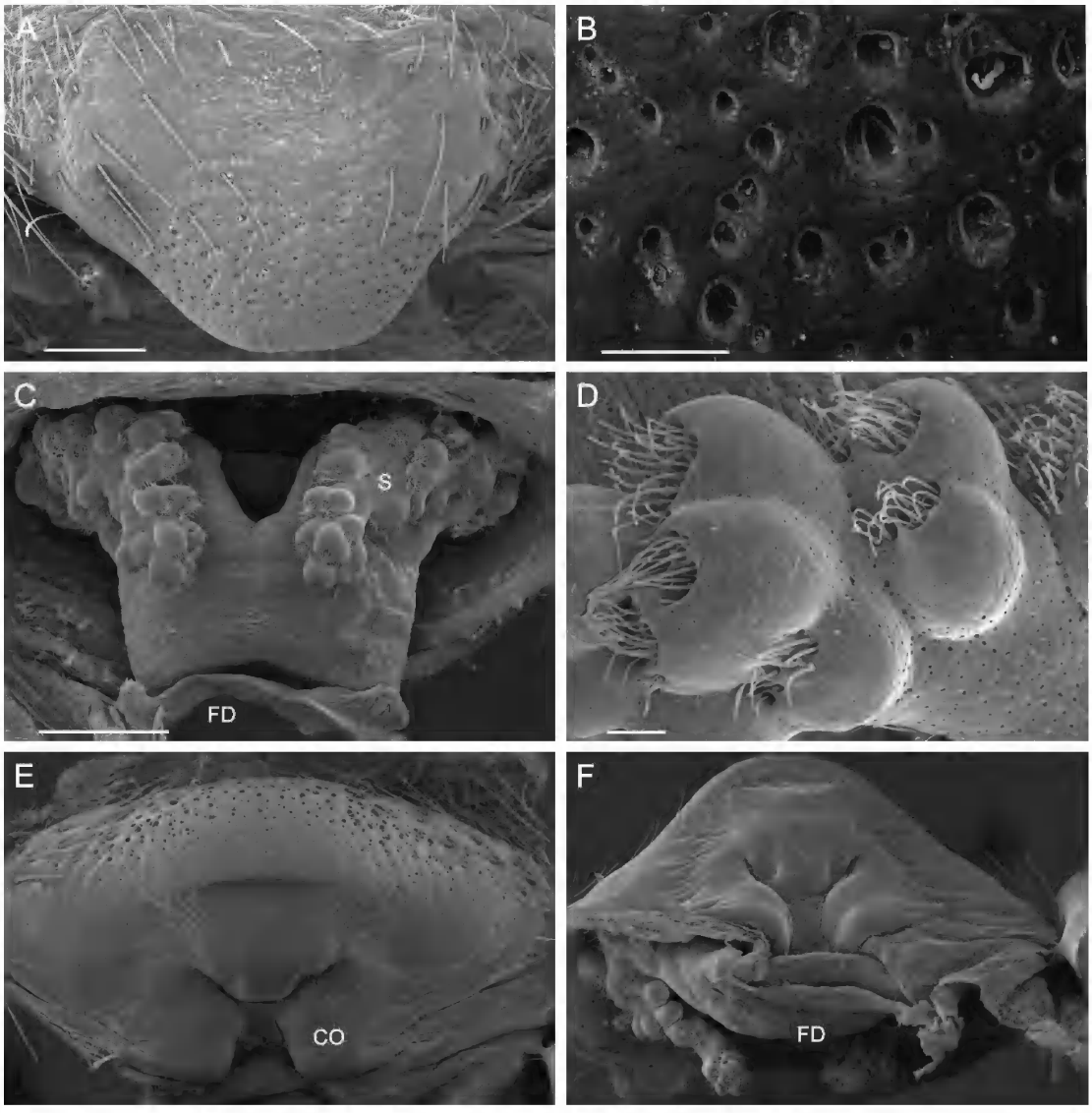

FIGURE 53. *Tawhai arborea*, epigynum. **A.** Ventral. **B.** Ventral pores, detail. **C.** Apical. **D.** Detail of accessory glands. **E.** Caudal. **F.** Dorsal. Scale bars: A, C, 0.2 mm; B, D, 0.02 mm.

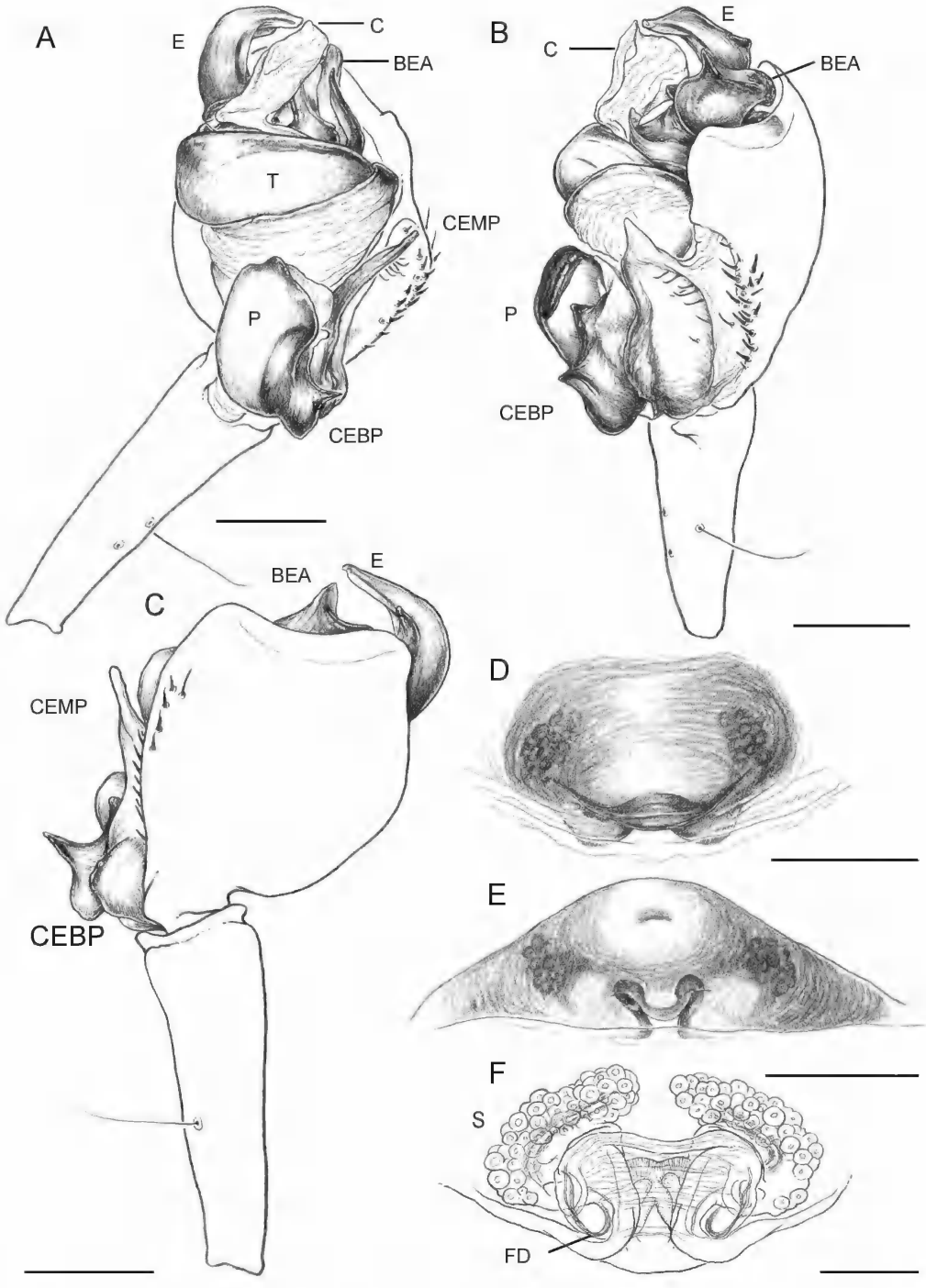

FIGURE 54. *Tawhai arborea* (male: S58330, TEAU028; female: TEAU026). **A.** Pedipalp, ventral. **B.** Pedipalp, ectal. **C.** Pedipalp, dorsal. **D.** Epigynum, ventral. **E.** Epigynum, caudal. **F.** Epigynum, dorsal. Scale bars: A–D, 0.5 mm; E, 0.2 mm.

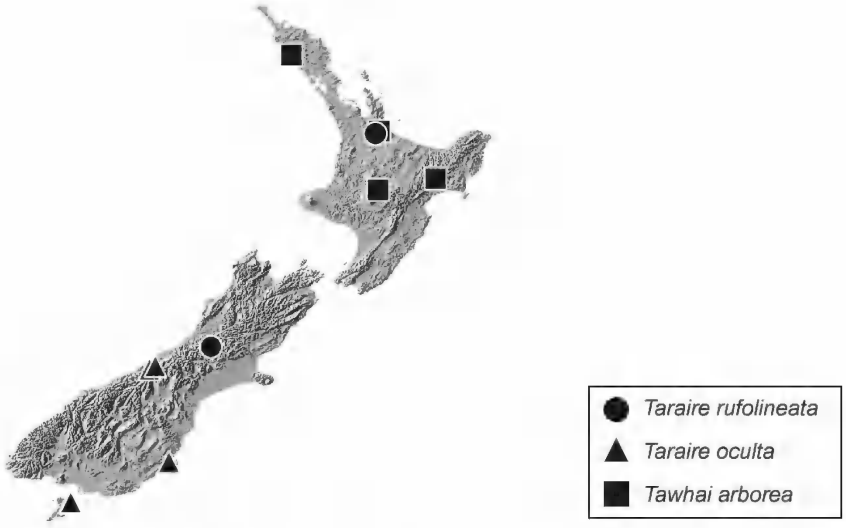

FIGURE 55. Distribution of *Taraire* and *Tawhai* in New Zealand.

1 female (field image voucher photos DSC_7946–7949/2.ii.2012GH) GWU; 1 female (field image voucher photos DSC_7965–7967/2.ii.2012GH) GWU; Franz Josef Glacier, Alex Knob Track, 43° 24′ 39.0″ S, 170° 10′ 59.4″ E, 182 m. G. Hormiga, G. Giribet, M. Arnedo, R. Fernández, F. Álvarez-Padilla, R.J. Kallal, C. Baker, 17 January 2016, 1 male, 2 females GWU; Leith Saddle Track, 45° 47′ 58.4″ S, 170° 30′ 55.7″ E, 377 m. G. Hormiga, G. Giribet, M. Arnedo, R. Fernández, F. Álvarez-Padilla, R.J. Kallal, C. Baker, 22 January 2016, 1 male GWU; Stewart Island, Rakiura National Park, Fern Gully, 46° 53′ 27.5″ S, 168° 5′ 47.8″ E, 51 m, G. Hormiga, G. Giribet, M. Arnedo, R. Fernández, F. Álvarez-Padilla, R.J. Kallal, C. Baker, 20 January 2016, 1 male, GWU.

Genus ***Tawhai***, gen. nov.

Figures 51–55

TYPE SPECIES: *Tetragnatha arborea* Urquhart, 1891.

DIAGNOSIS: In *Tawhai* the epigynum protrudes ventrally and its posterior margin extends beyond the epigastric furrow, like in *Taraire* (figs. 51D, 53A), but differs from the latter genera by the following characters: spermathecae cuticle covered with sclerotized clusters that bear the accessory glands openings (figs. 51H, 53C, D), copulatory ducts absent (the spermatheca opens directly in the epigynum plate as in *Meta*) and long and straight fertilization ducts enclosed by a membrane that communicates with the uterus externus (figs. 53F, 54F). Externally the epigynum bears several holes (observed only with SEM fig. 53A, B) that resemble those of *Pinkfloydia* (Dimitrov and Hormiga, 2011: figs. 15D, E, G); however, it differs from this Australian genus in the eyes, which are organized in two lines, and in having the spermathecae cuticle heavily sclerotized (figs. 51H, 53C). The CEBP is similar to that of *Allende* species in having a finger-shaped paracymbium with a sclerotized apical keel, an L-shaped long apophysis between the paracymbium and the basal part of the CEBP and the presence of short and thick macrosetae on the CEMP (figs. 52D, 54A–C). *Tawhai* differs from *Allende* by the lack of teeth on the cymbial apophysis and the CEBP base, the separation of the CEBP base from the cymbium by a membranous section (figs. 52D, 54C) and the CEMP

contiguous with the cymbium margin (fig. 54A–C). *Tawhai* has a large and heavily sclerotized embolic apophysis similar to that of *Taraire* species, but it differs from the latter genus in the shape of this embolic apophysis (fig. 52C). In addition, the following features are unique to *Tawhai*: a short, rectangular, and membranous conductor separated from the embolus except at the apex (figs. 52A, C, 54A), embolus the largest sclerite with a hook shape in ventral view and bearing a subterminal spine observed in apical or mesal view (figs. 52B, 54A).

DESCRIPTION: Female total length 8.4. Cephalothorax length 3.6, width 2.7. Carapace glabrous, pale yellow with dark-brown markings over the fovea, extending to the dorsal surface of the ocular area and two patches over the chelicerae (fig. 51A). Ocular area dark brown, fovea longitudinal. Clypeus height 0.4 AME diameter. Eyes subequal in size. Chelicerae dark brown, glabrous cuticle smooth (fig. 51G). Three prolateral, two retromarginal teeth, and ca. two denticles between margins. Endites brown, internal margins pale-yellow, longer than wide. Labium rectangular, wider than long, same color as the endites. Sternum pale yellow, trapezoidal, wider between the first two legs (fig. 51E). Abdomen dorsum with scattered guanine white patches intercalated with dark-brown transverse bands against a light-brown background (fig. 51A); lateral surface with intercalated diffused brown stripes and white guanine patches (fig. 51C); ventral surface light brown with scattered guanine patches flanked by dark-brown irregular lines (fig. 51E). Booklung covers without stridulatory organs. Spinnerets brown, lighter pattern on internal surfaces. Ultrastructure of abdomen, tracheae and spinnerets observed with SEM. Abdomen cuticle flat reticulated, all tracheae not ramified, median tracheae tip leaf shaped. ALS one major ampullate, one nubbin, ca. 80 piriform, tartipores present. PMS one minor ampullate, one nubbin, and one cylindrical and three central aciniform. PLS aggregate and flagelliform spigot tips clustered together, ca. 18 aciniform spigots distributed in two parallel rows, two cylindrical gland spigots at periphery (fig. 51B). Leg formula 1-2-4-3, Femur I length 4.9. Background of legs yellow on the basal segments, becoming dark brown toward the apex, basal segments decorated with dark-brown annuli. All femora without trichobothria. Macrosetae few and present on all segments except metatarsi and tarsi. Spermathecae heavily sclerotized, covered with small sclerotized globular clusters with accessory gland ducts (figs. 51H, 53C, D, 54F). Copulatory ducts reduced, opening directly into the epigynal plate. Fertilization ducts sclerotized, long, narrow and inside a membranous sac that connects with the uterus externus (figs. 53E, F, 54F). Genital openings on the median posterior surface, median plate membranous (fig. 54E).

Male same as female except as noted. Total length 8.2. Cephalothorax length 4.4, width 3.2. Clypeus height 0.6 AME diameter. Chelicerae longer than female (fig. 51G, I), distal part with three promarginal, two retromarginal teeth and one denticle between margins. Femur I length 8.9. Male pedipalpal tibia three times as long as wide, apical margin bordered with a cuticlar rim (the male palpal morphology is described in Diagnosis; see figs. 52, 54).

COMPOSITION: Monotypic.

SYSTEMATICS: *Tawhai* is sister to *Taraire* (figs. 61–63), but the placement of the two genera together is unstable. Autapomorphies of *Tawhai* include the concavity of the ectal cymbial margin (figs. 52D, 54B), bearing macrosetae and the sclerotized globular clusters with accessory gland ducts that cover the spermathecae (figs. 53C, D, 54F).

ETYMOLOGY: The genus is named after the Māori word (*tawhai*) for the New Zealand endemic tree *Nothofagus menziesii* (Hook.f.) Oerst. (Nothofagaceae), the silver beech. It is indeclinable and feminine in gender.

DISTRIBUTION: *Tawhai* is found only in the North Island of New Zealand (fig. 55).

NATURAL HISTORY: The web of *Tawhai arborea* is given under the species description below.

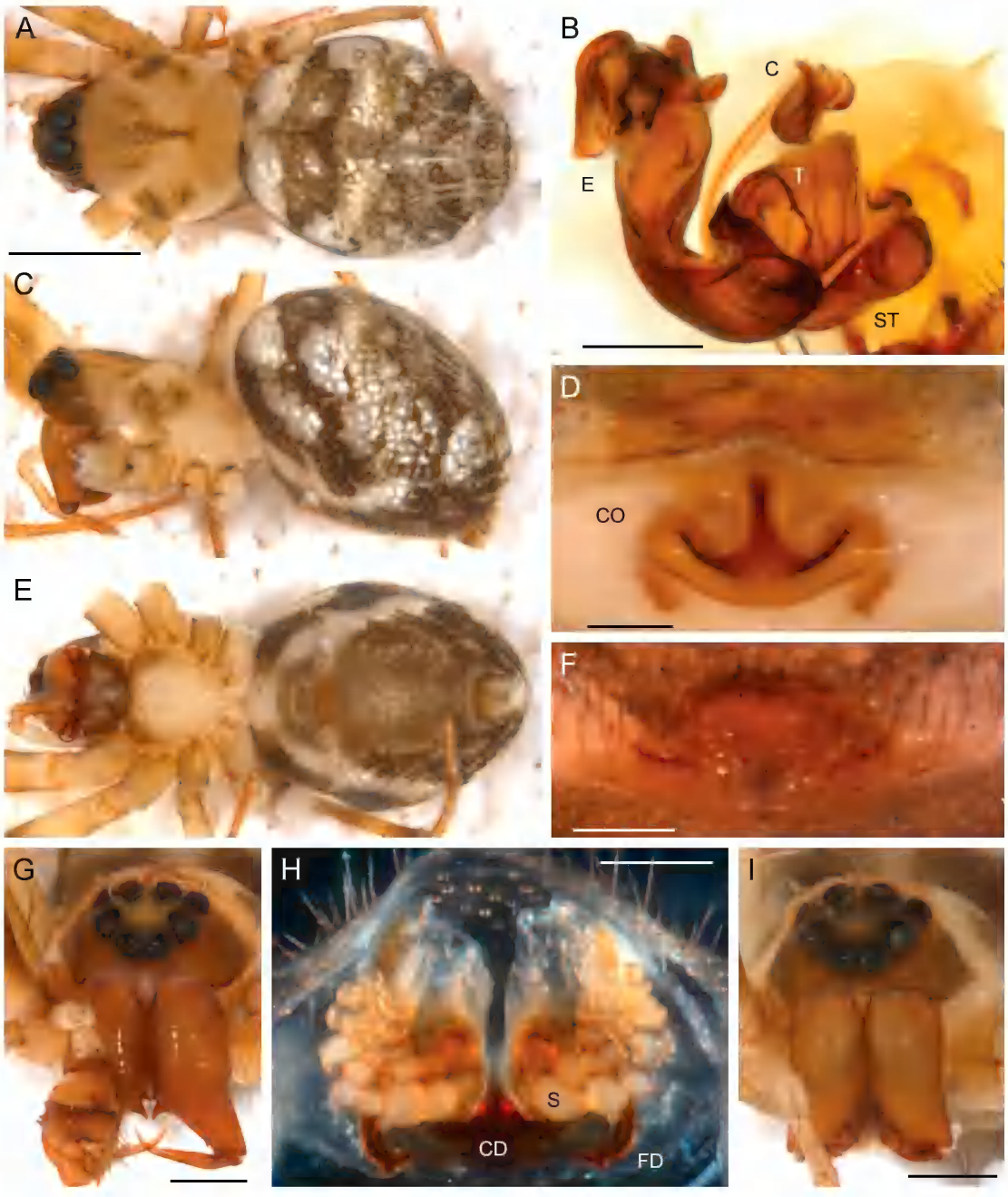

FIGURE 56. *Iamarra multitheca* (female: TEUA015, TEAU020; male: TEAU014, TEAU041). **A.** Female, dorsal habitus. **B.** Pedipalp, expanded. **C.** Female, lateral habitus. **D.** Epigynum, caudal. **E.** Female, ventral habitus. **F.** Epigynum, ventral. **G.** Male, frontal habitus. **H.** Epigynum, dorsal digested. **I.** Female, frontal habitus. Scale bars: A, C, E, 1.0 mm; B, 0.2 mm; D, F, H, 0.1 mm; G, I, 0.5 mm.

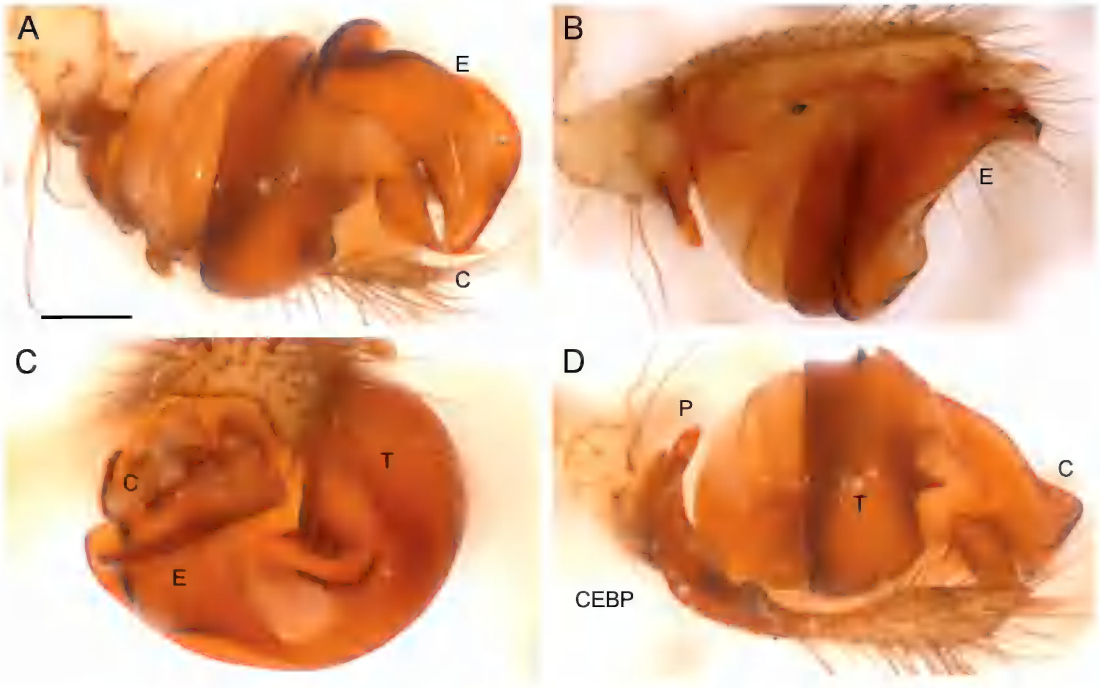

FIGURE 57. *Iamarra multiteca* pedipalp (TEAU014). **A.** Ventral. **B.** Mesal. **C.** Apical. **D.** Ectal. Scale bars: 0.2 mm.

Tawhai arborea (Urquhart, 1891), comb. nov.

Figures 51–55

Tetragnatha arborea Urquhart, 1891: 172, pl. 21, fig. 9. Syntypes not examined, description and illustrations accurate enough to make reliable identification.

TYPE MATERIAL: The syntypes (males and females, from New Zealand, North Island, Stratford, Taranaki) are not at the Canterbury Museum (Nicholls et al., 2000) and are probably lost (C. Vink, in litt., to G.H.).

DIAGNOSIS AND DESCRIPTION: See genus diagnosis and description. Female description based on specimens (TEAU026, TEAU047). Male description based on specimen (TEAU028).

VARIATION: Females ($N = 2$) total length 8.36–9.13. Cephalothorax length 3.63–4.12, width 2.73–3.14. Femur length 4.91–5.80.

DISTRIBUTION: *Tawhai arborea* is found in New Zealand's North Island (fig. 55).

NATURAL HISTORY: *Tawhai arborea* builds vertical orb webs with open hubs, few radii, and sticky spirals. The web illustrated in figure 5C had a height of 34 cm (from top to bottom spiral thread). Forster and Forster (1999: 166, fig. 11.28a) describe their webs as large, "up to a metre wide, with widely spaced sticky threads. They are also found within the forest, and their webs may be tilted at a slight angle over running water."

REMARKS: *Tetragnatha arborea* was considered a synonym of *Orsinome lagenifera*, but these species differ considerably in their morphology. *Tawhai arborea* was misidentified in the phylogenetic analysis of Wheeler et al. (2017) as "*Allende* sp. CG103." Our phylogenetic analysis suggests that both *Taraire* and *Tawhai* are not close relatives of *Orsinome*.

MATERIAL EXAMINED: $N = 6$. NEW ZEALAND, North Island, Te Urewera National Park, Lake Waikaremoana, trail to Lake Waikareiti, 38° 44′ 32″ S, 177° 9′ 53.1″ E, 650 m., G. Hormiga, 6–11 April 2011, night collecting

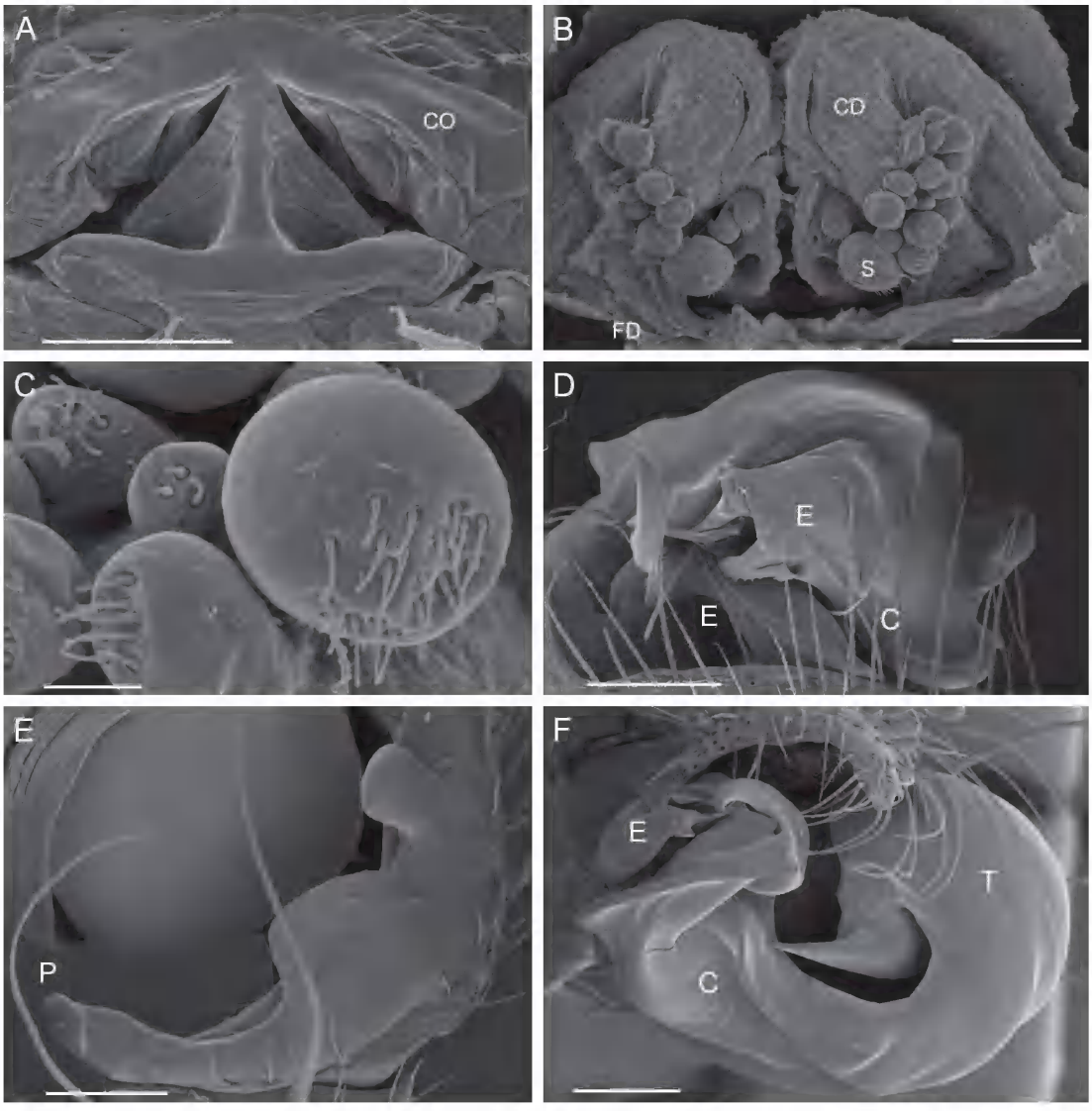

FIGURE 58. *Iamarra multitheca* (TEAU041). **A.** Epigynum, caudal. **B.** Epigynum, apical. **C.** Epigynum, accessory glands. **D.** Pedipalp, embolus detail. **E.** Pedipalp, paracymbium and ectal processes detail. **F.** Pedipalp, apical. Scale bars: A, B, D–F, 0.1 mm; C, 0.02 mm.

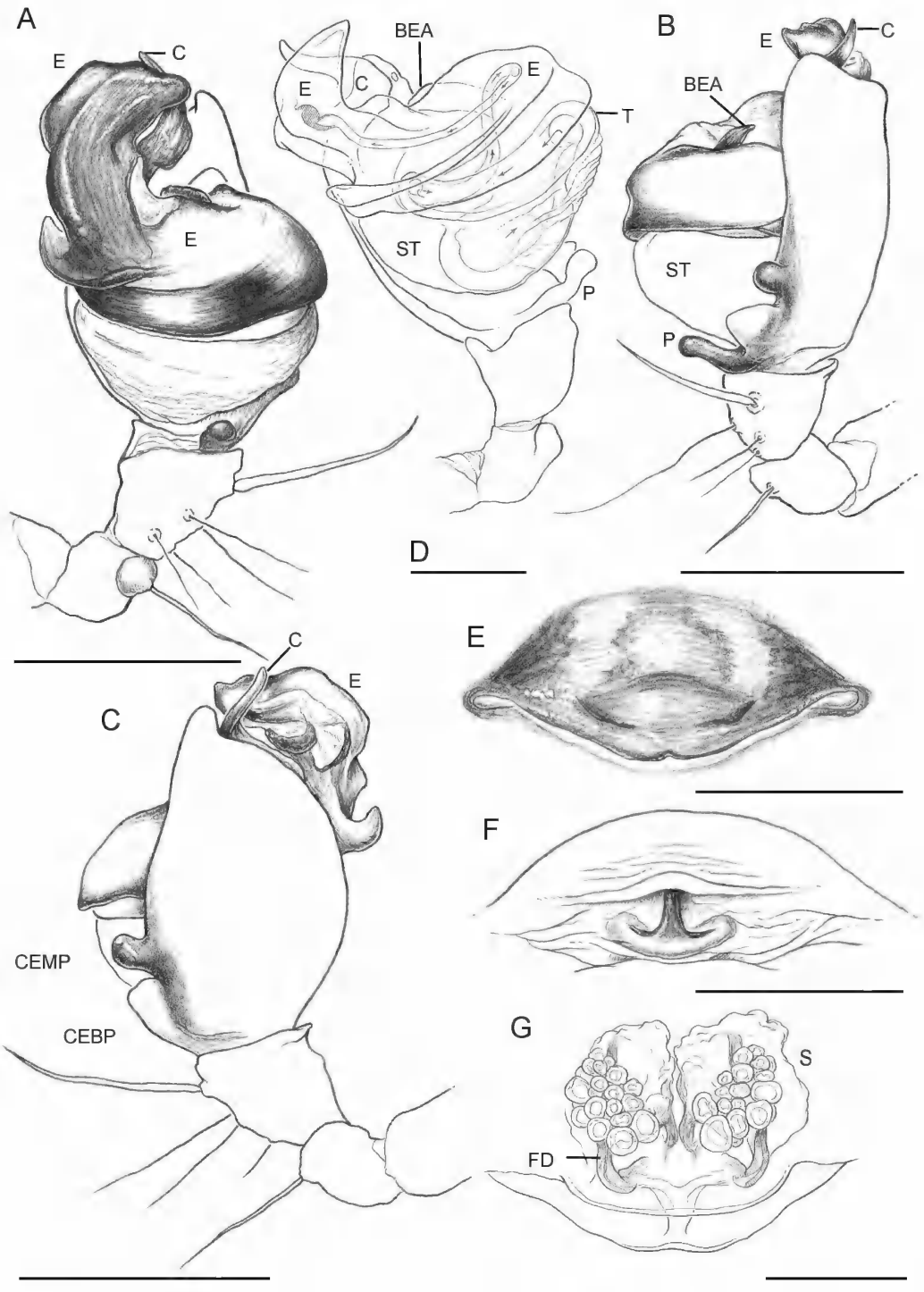

FIGURE 59. *Iamarra multitheca* (TEAU041). **A.** Pedipalp, ventral. **B.** Pedipalp, ventral (schematic and cleared). **C.** Pedipalp, ectal. **D.** Pedipalp, dorsal. **E.** Epigynum, ventral. **F.** Epigynum, caudal. **G.** Epigynum, dorsal. Scale bars: 0.5 mm.

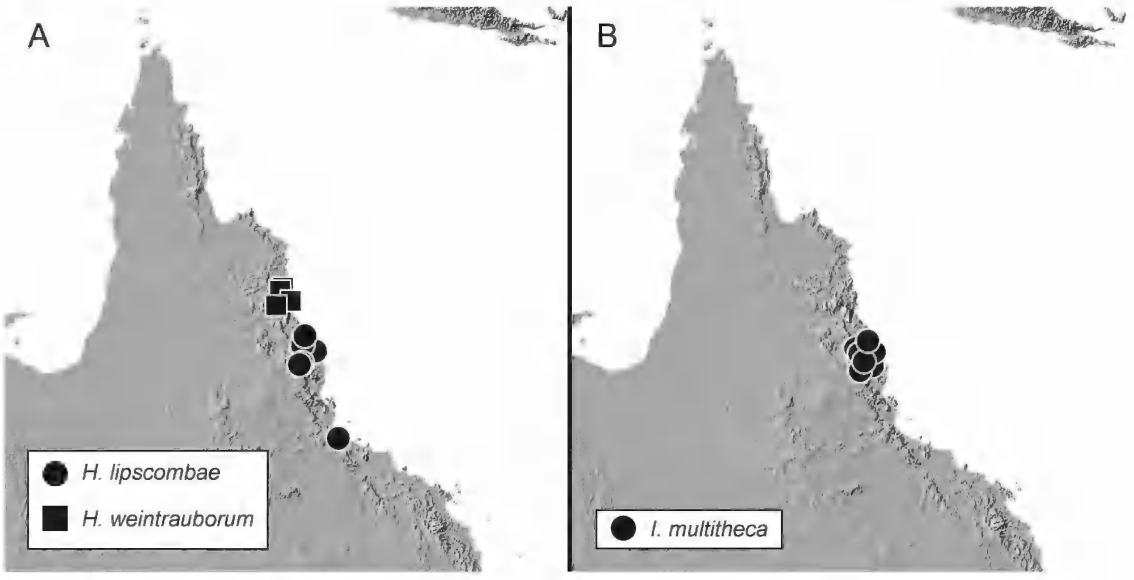

FIGURE 60. Distribution of new genera in Queensland. **A.** *Harlanethis.* **B.** *Iamarra.*

(label ambiguity, could be Panekiri Bluffs trail), 1 female (image voucher TEAU026) GWU; Te Urewera National Park, Lake Waikaremoana, trail to Lake Waikareiti, 38° 44′ 32″ S, 177° 9′ 53.1″ E, 650 m., G. Hormiga, 6–11 April 2011, 5 females, 3 immatures (image voucher TEAU047) GWU; Tongariro National Park, Lake Rotopounamu Walk, 39° 1′ 14.5″ S, 175° 43′ 58.6″ E, 744 m., G. Hormiga & N. Scharff, 17 April 2011, 1 female, 1 immature (DNA voucher GH1117) GWU; Tongariro National Park, Lake Rotopounamu Walk, 39° 1′ 14.5″ S, 175° 43′ 58.6″ E, 744 m., G. Hormiga & N. Scharff, 17 April 2011, 1 female (field image voucher photos 6279–6287 and GH1117 DNA series) GWU; Waiorongomai Valley, Te Aroha, 37° 33′ 39.25″ S, 175° 45′ 27.81″ E, 72 m, D.J. Court, 15 May 1984, 1 male, 1 female (male image voucher TEAU028 and also Paratypes) S58330 QM; Waipoua SF, Toronui Tr., 35° 39′ 42.92″ S, 173° 34′ 22.16″ E, 150 m, A. Newton & M. Thayer, 13 April 1980, Kauri-podocarp-broadleaf-nikau palm forest, fungusy log, pyrethrin fogging, 1 female AMNH.

Genus ***Iamarra,*** gen. nov.

Figures 6, 56–60

TYPE SPECIES: *Iamarra multitheca.*

DIAGNOSIS: The only species included in *Iamarra* builds dense horizontal orb webs between tree buttresses (fig. 6A, B) that resemble those of *Dolichognatha* O. Pickard-Cambridge, 1869, and has the lateral eyes nonjuxtaposed, on separated tubercles, a feature it shares with *Diphya* Nicolet, 1849. *Iamarra* differs from both those genera by having all eyes of equal size (fig. 56G, I) and by lacking the leg I spination pattern of *Diphya* and from all other tetragnathids by the presence of the following unique features: embolus very large (the largest palpal sclerite), lamelliform and coiling around a slender conductor (figs. 56B, 57A–C, 59A), apically divided in a sclerotized lamella and a membranous sac where the spermatic duct opens (figs. 57C, 58D, 59B); conductor base thin and translucent, tip sclerotized and hook shaped (figs. 57A, 59A, C–D). The epigynum morphology is also unique and diagnostic, flat and trapezoidal in shape (figs. 56F, 59E), with the genital openings inside the epigastric furrow, slit shaped within a

partially sclerotized triangular plate (figs. 56D, 58A, 59F), and with the spermathecae divided in clusters (figs. 56H, 58B, C, 59G).

DESCRIPTION: Male total length 3.92. Cephalothorax length 1.82, width 1.44. Carapace glabrous, pale yellow with dark-gray markings over fovea, extending to dorsal surface of ocular area and two patches over legs I and II. Ocular area dark brown under clypeus and laterally (fig. 56G). Fovea longitudinal, between two bulges of thoracic area. Clypeus height 0.42 AME diameter. Eyes subequal in size. Lateral eyes not juxtaposed, separated more than one lateral eye diameter. Chelicerae brown, glabrous, distal part divergent and fangs enlarged (fig. 56G), without ventral stridulatory ridges, with two pro- and one retromarginal teeth and three denticles between margins. Endites brown, internal margins pale yellow, longer than wide. Labium rectangular, wider than long, same color as endites. Sternum pale yellow with two anterior dark-gray markings, trapezoidal, wider between the first three legs. Abdomen dorsum covered with guanine white patches intercalated with dark-brown transverse bands over a gray background; laterally with diffused brown vertical stripes and white guanine patches; ventral surface dark brown without guanine patches. Booklung covers without striae. Spinnerets brown, lighter pattern on internal surfaces. Leg formula 1-2-4-3, Femur I length 3.29. All femora, patella, and tibia brown-yellow, with dark-brown annuli. All leg segments apically dark brown. All femora without trichobothria. Macrosetae few and present on all segments except metatarsi and tarsi. Male pedipalpal tibia triangular, as long as wide, apical margin wider and bordered with a translucent cuticle rim. CEBP and CEMP reduced and without macroseta. Paracymbium contiguous with cymbium, slender, with few basal setae, slightly curved apically (figs. 57D, 58E, 59C–D). Embolic basal apophysis small and triangular (fig. 59 C–D). Conductor fused to the tegular margin. Spermatic duct spiral without switchbacks (fig. 59B).

Female same as male except as noted. Total length 3.77. Cephalothorax length 1.68, width 1.35. Clypeus height 0.49 AME diameter. Chelicerae smaller than male, distal part straight, fangs not enlarged (fig. 56I), with three promarginal and two retromarginal teeth, and two denticles between margins. Ultrastructure of abdomen and spinnerets observed with SEM. Abdomen cuticle flat reticulated, all tracheae tubular, median tracheae restricted to abdomen, tracheal atrium glands present. ALS with one major ampullate, one nubbin, and ca. 45 piriform spigots. PMS with one minor ampullate, one nubbin, and one cylindrical and three central aciniform spigots. PLS araneoid triplet with base clustered together, aggregate and flagelliform tips not separated, ca. 12 aciniform distributed at the center, and two peripheral cylindrical spigots. Femur I length 2.85. Spermathecae membranous and covered with small sclerotized globular clusters with accessory gland ducts, duct bases flat (figs. 58B, C, 59G). Copulatory ducts reduced to a sclerotized rim that opens directly into the membranous spermathecae. Fertilization ducts sclerotized, following a straight path under the accessory gland clusters, apically bent 90° (fig. 59G).

COMPOSITION: Monotypic.

SYSTEMATICS: Autapomorphies of *Iamarra* include the massive embolus, with its apical region divided into a sclerotized lamella and a membranous sac where the spermatic duct opens (figs. 58D, 59B) and the spermathecae with small, sclerotized globular clusters with accessory gland ducts (fig. 58B, C). The phylogenetic placement of this genus is weakly supported in our analyses (figs. 61–63).

ETYMOLOGY: The genus name is derived and modified from the Ngadjon word for a spider web (*jamarra*). The Ngadjonji people are one the aboriginal inhabitants of what is now known as the Atherton Tablelands, in North Queensland, Australia. Their language is part of the Dyirbal group. *Iamarra* is indeclinable and feminine in gender.

DISTRIBUTION: This genus is found in northern Queensland (fig. 60B).

NATURAL HISTORY: The web of *Iamarra multitheca* is described in the section below.

Iamarra multitheca, sp. nov.

Figures 6, 56–60

TYPE MATERIAL: Female holotype and male allotype from NE Queensland, 3 km W. Bones Knob 17° 13′ S, 145° 25′ E, 1100 m. 10 December 1995, Monteith, Cook & Thompson, between trees and logs of Pyrethrum sp. (QM)

DIAGNOSIS AND DESCRIPTION: See genus diagnosis and description. Female description based on specimens (TEAU015, TEAU020 to 22, TEAU041). Male description based on specimens (TEAU014, TEAU041).

VARIATION: Males (N = 5) total length 3.44–4.20. Cephalothorax length 1.82–2.09, width 1.39–1.58. Femur length 2.88–3.31. Females (N = 5) total length 3.54–3.84. Cephalothorax length 1.49–1. 67, width 1.17–1.35. Femur length 2.43–2.85. The epigynum triangular plate base varies from straight to slightly curved.

ETYMOLOGY: The species epithet refers to the characteristic spermathecae of this species, which are conspicuously divided several globular clusters (from the Greek word *theca* a chest, box, or other container).

DISTRIBUTION: This species is endemic to Queensland (fig. 60B).

NATURAL HISTORY: *Iamarra multitheca* is found exclusively in the tropical region of northern Queensland. These spiders build dense, horizontal webs, which may or may not have open hubs, at the base of tree trunks (fig. 6).

REMARKS: This species was misidentified in Wheeler et al. (2017) as "*Dolichognatha* sp. GH59."

MATERIAL EXAMINED: N = 130. AUSTRALIA: Queensland, 3 km W. Bones Knob, 17° 13′ S, 145° 25′ E, 1100 m, Monteith, Cook & Thompson, 10 December 1995, trees and logs of Pyrethrum sp. 2 males, 4 females, 2 immatures (Holotype and allotype taken from this specimen series) QM S38211; Atherton Tablelands, Rose Gums Wilderness Retreat, 12.4 km ENE Malanda, 17° 18′ 51.1″ S, 145° 42′ 8.6″ E, 770 m, G. Hormiga & L. Lopardo, 15–16 March 2006, 1 female (GH0150), GWU; Atherton Tablelands, Wongabel State Forest, 10.8 km west of Malanda, 17° 19′ 55.4″ S, 145° 30′ 1.9″ E, 740 m, G. Hormiga & L. Lopardo, 16 March 2006, 2 males, 1 female, 4 immatures, GWU. 1 female (image vouchers TEAU015 and TEAU021), GWU; Atherton Tablelands, Wongabel State Forest, 10.8 km west of Malanda, 17° 19′ 55.4″ S, 145° 30′ 1.9″ E, 740 m, G. Hormiga & L. Lopardo, 16 March 2006, 1 male (image voucher TEAU014), GWU; Atherton Tablelands, Wongabel State Forest, 10.8 km west of Malanda, 17° 19′ 55.4″ S, 145° 30′ 1.9″ E, 740 m, G. Hormiga & L. Lopardo, 16 March 2006, 1 male, 3 females, 4 immatures, GWU; Crater Lakes National Park Lake Barrine, 17° 14′ 41.5″ S, 145° 38′ 31″ E, 808 m. G. Hormiga, N. Scharff, & J. Pedersen, 9–10 February 2012, Rainforest Walk Trail, night collection, 1 female, GWU; Crater Lakes National Park Lake Barrine, 17° 14′ 41.5″ S, 145° 38′ 31″ E, 808 m. G. Hormiga, N. Scharff, & J. Pedersen, 9–10 February 2012, Rainforest Walk Trail, night collection, 8 males, 17 females, 4 immatures, GWU; Crater Lakes National Park Lake Barrine, 17° 14′ 41.5″ S, 145° 38′ 31″ E, 808 m. G. Hormiga, N. Scharff, & J. Pedersen, 9–10 February 2012, Rainforest Walk Trail, night collection, 1 male, 1, female, 5 immatures (GH1142), GWU; Crater Lakes National Park Lake Barrine, 17° 14′ 41.5″ S, 145° 38′ 31″ E, 808 m. G. Hormiga, N. Scharff, & J. Pedersen, 9–10 February 2012, Rainforest Walk Trail, night collection, 1 female (G. Hormiga field image photos 8069-8077GH), GWU; Crater Lakes National Park Lake Barrine, 17° 14′ 41.5″ S, 145° 38′ 31″ E, 808 m. G. Hormiga, N. Scharff, & J. Pedersen, 9–10 February 2012, Rainforest Walk Trail, night collection, 1 female (photo voucher 8078-8082GH), GWU; Crater Lakes National Park Lake Barrine, 17° 14′ 41.5″ S, 145° 38′ 31″ E, 808 m. G. Hormiga, N. Scharff, & J. Pedersen, 9–10 February 2012, Rainforest Walk Trail, night collection, 1 female (G. Hormiga field photos 8083-8090GH), GWU; Atherton Tablelands, Lake Tinaroo, Danbulla

State Forest, 17° 10′ 30″ S, 145° 39′ 34″ E, 810 m. G. Hormiga, M. Kuntner, & F. Álvarez, 21 April 2002, dry forest, 1 female (photo voucher R7/18-24GH), GWU. 1 female (photo voucher R7/25-31GH), GWU; Atherton Tablelands, Lake Tinaroo, Danbulla State Forest, 17° 10′ 30″ S, 145° 39′ 34″ E, 810 m. G. Hormiga, M. Kuntner, & F. Álvarez, 21 April 2002, dry forest, 1 female, 1 male, GWU; Atherton Tablelands, Lake Tinaroo, Danbulla State Forest, 17° 10′ 30″ S, 145° 39′ 34″ E, 810 m. G. Hormiga, M. Kuntner, & F. Álvarez, 21 April 2002, dry forest, 2 males, GWU; Atherton Tablelands, Lake Tinaroo, Danbulla State Forest, 17° 10′ 30″ S, 145° 39′ 34″ E, 810 m. G. Hormiga, M. Kuntner, & F. Álvarez, 21 April 2002, dry forest, 1 female, GWU; Atherton Tablelands, Lake Tinaroo, Danbulla State Forest, 17° 10′ 30″ S, 145° 39′ 34″ E, 810 m. G. Hormiga, M. Kuntner, & F. Álvarez, 21 April 2002, dry forest, 5 females (variation vouchers images TEAU020, TEAU022), GWU; Atherton Tablelands, Lake Tinaroo, Danbulla State Forest, 17° 10′ 30″ S, 145° 39′ 34″ E, 810 m. G. Hormiga, M. Kuntner, & F. Álvarez, 21 April 2002, dry forest, 1 male, 1 female, GWU; Atherton Tablelands, Land Rd., Rose Gums Wilderness Retreat ca. 13 km NE of Malanda, ridge trail behind Bowebird Cabin, 17° 18′ 50.6″ S, 145° 42′ 10.6″ E, 725 m, G. Hormiga, N. Scharff, & J. Pedersen, 8 14 February 2012, general collecting, 3 females, GWU; Atherton Tablelands, Mount Hypipamee National Park, near the Crater, 17° 25′ 35.8″ S, 145° 29′ 8.9″ E, 945 m. G. Hormiga, N. Scharff, J. Pedersen, 11–13 February 2012, 3 females (behavioral voucher) GWU; Atherton Tablelands, Tully Falls National Park S of Ravenshoe, Charmillin Creek, Wabunga Wayemba, 17° 42′ 0.8″ S, 145° 31′ 20.8″ E, 931 m. G. Hormiga, N. Scharff, J. Pedersen 12 February 2012, Rainforest walkabout, 1 female, GWU; Atherton Tablelands, Wongabel State Forest, 17° 9′ 54″ S, 145° 30′ 8.6″ E, 765 m, G. Hormiga, N. Scharff, J. Pedersen, 13 February 2012, 6 males, 10 females (1 male, 1 female, SEM vouchers TEAU041), GWU; Bellenden Ker National Park Palmerston Hwy. 29.3 km SSW of Innisfail, Wallichen Falls area, 17° 36′ S, 145° 47′ E, 217 m. G. Milledge, 23 April 1998, rainforest, 1 male, KS52440; Bellenden Ker Range, 1/2 km S Cable Tower No 7, 17° 17′ 30.13″ S, 145° 49′ 32.29″ E, 500 m, 1–7 November 1981, 1 male, 2 females, 1 immature, QM S27787; Charmillin Creek, 17° 42′ S, 145° 31′ E, 940 m. G. Monteith, 1 December 1997, trees and logs Pyrethrum sp. 1 male, 2 females, 3 immatures, QM S43100; Millaa Millaa Falls, 17° 30′ S, 145° 36′ E, 834 m. G. Monteith, 23–24 November 1994, 3 males, 3 females, 2 immatures, QM S47055; Upper Isley Ck., 17° 3′ S 145° 41′ E, 750 m. Monteith & Janetzki, 29 November 1993, trees and logs Pyrethrum sp. 2 males, QM S31911.

PHYLOGENETICS

The best partitioning scheme for Bayesian analysis resulted in four partitions: 12S+16S (GTR+I+G), 18S+28S (GTR+I+G), COI codon position 3 (GTR+G), and all remaining partitions using SYM+I+G. The best scheme for IQ-TREE was 12S (TIM2+F+G4), 16S (GTR+F+I+G4), 18S (TNe+R4), 28S (GTR+F+R4), COI codon position 1 (GTR+F+G4), COI codon position 2 (GTR+F+G4), COI codon position 3 (K3Pu+F+I+G4), H3 codon position 1 (SYM+G4), H3 codon position 2 (K2P), and H3 codon position 3 (TIM2e+I+G4).

The resulting topologies are summarized in figures 61–63; differences are trivial, but we refer to figure 61 as our preferred topology, as it recovers Arkyidae as sister lineage to Tetragnathidae following phylogenomic results (e.g., Fernández et al., 2018, Kallal et al., 2018). All analyses strongly support the monophyly of Tetragnathidae. IQ-TREE and MrBayes analyses support the monophyly of Arkyidae + Mimetidae, whereas RAxML shows Arkyidae + Tetragnathidae, but the support is not high in any analysis. The first diverging taxon in

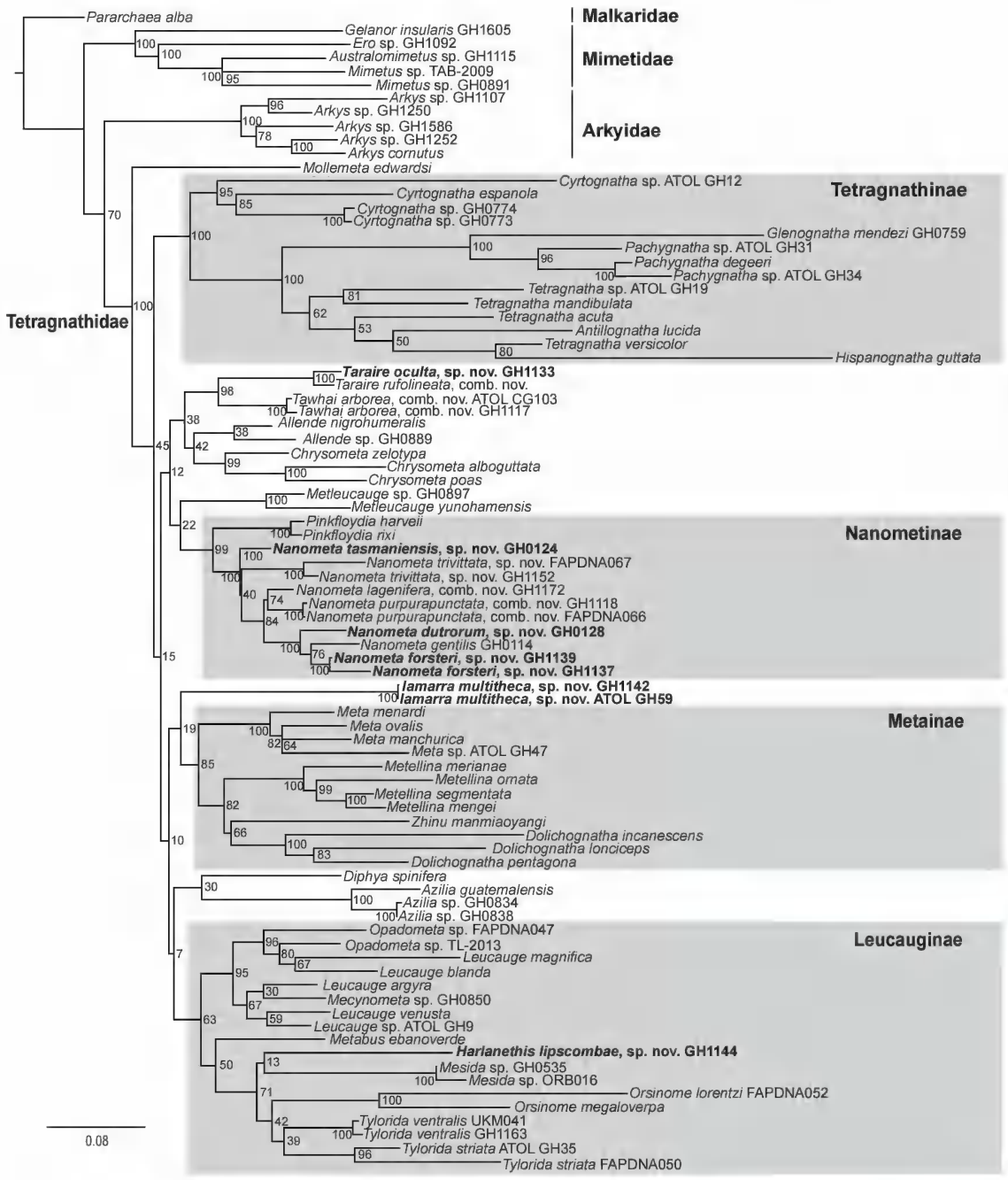

FIGURE 61. Phylogeny of Tetragnathidae using RAxML. Values at nodes are bootstrap supports. New taxa are demarcated in bold and subfamilies demarcated in colored boxes.

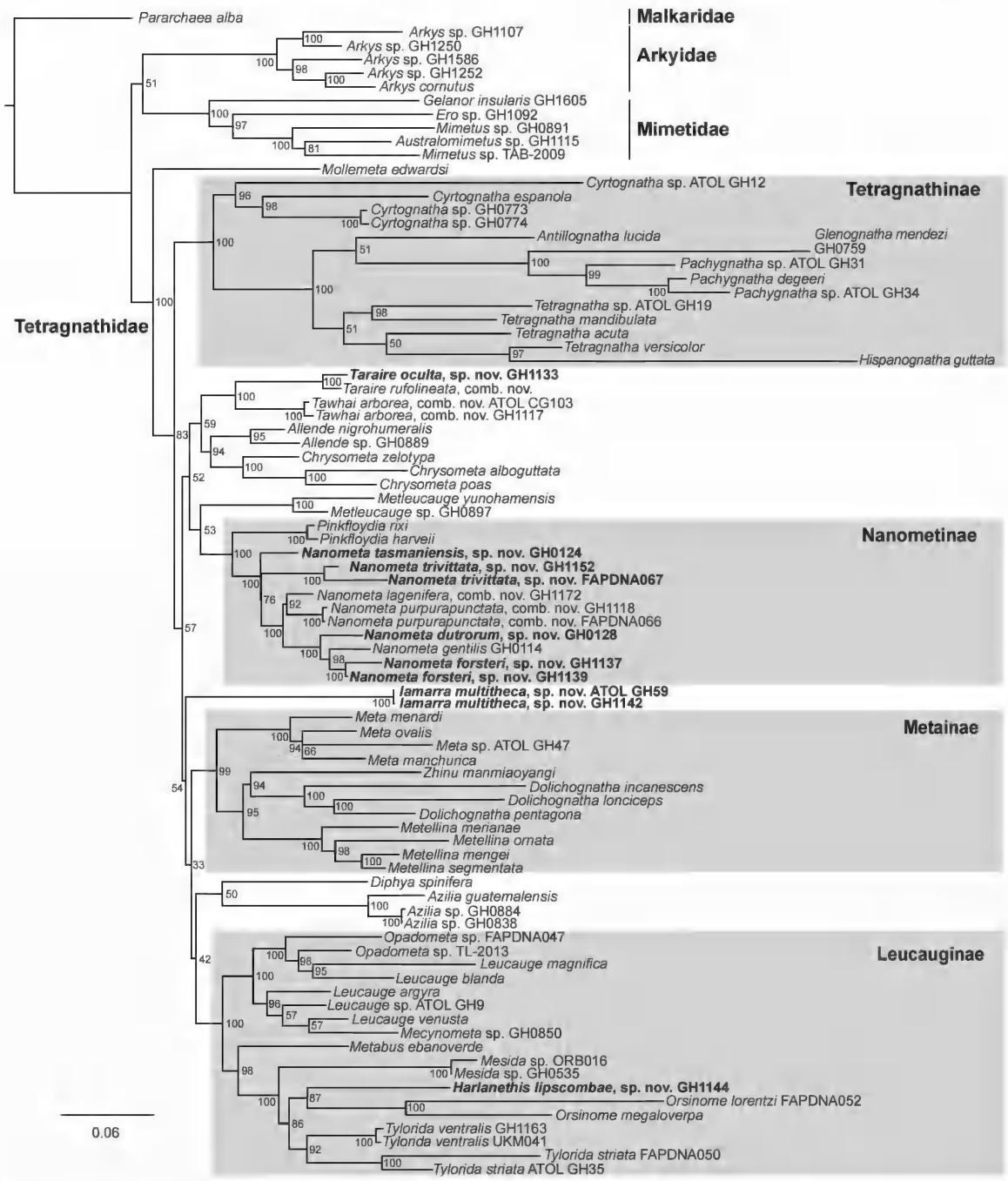

FIGURE 62. Phylogeny of Tetragnathidae using IQ-TREE. Values at nodes are ultrafast bootstrap supports. New taxa are demarcated in bold and subfamilies demarcated in colored boxes.

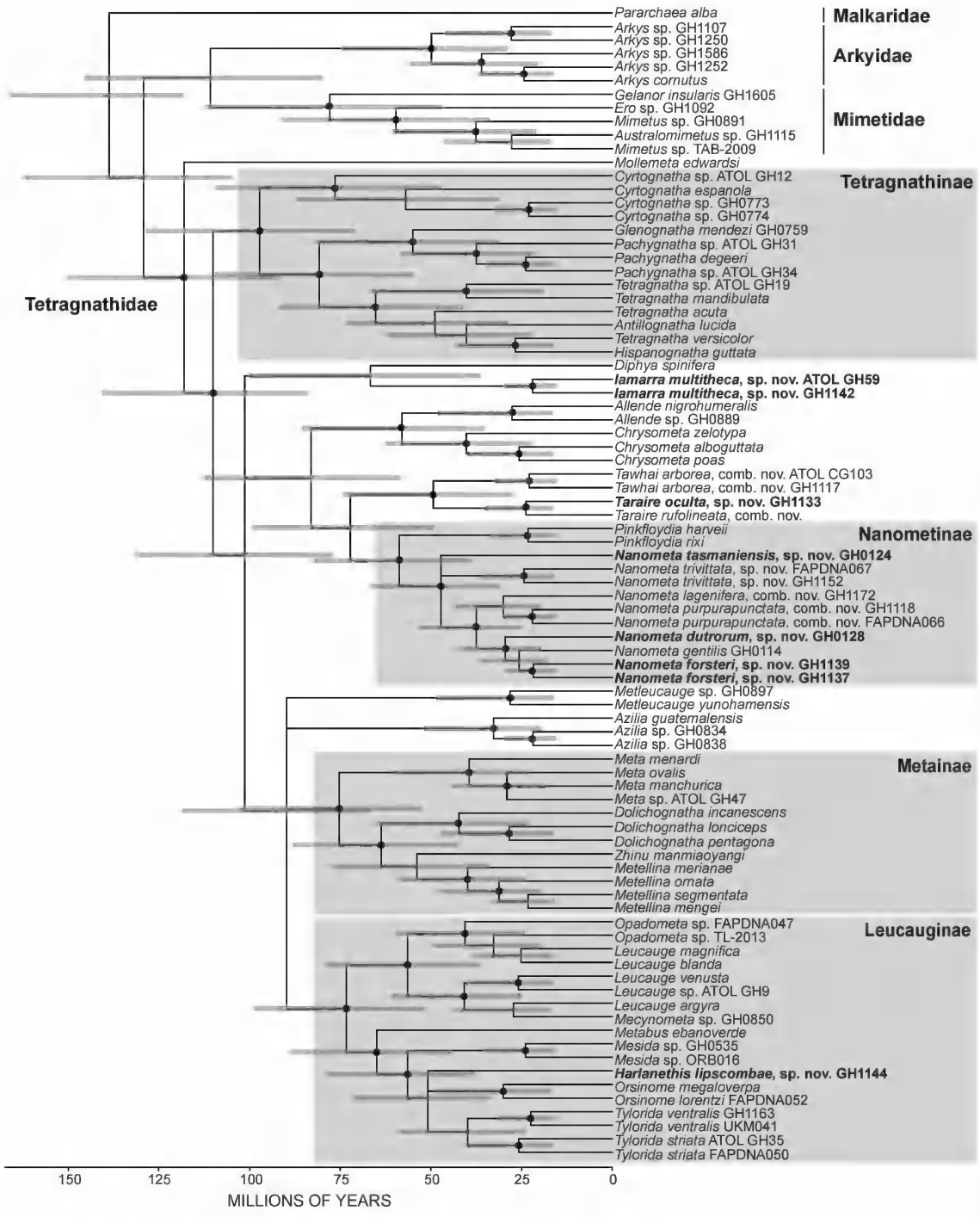

FIGURE 63. Phylogeny of Tetragnathidae using MrBayes. Values at nodes are posterior probabilities. New taxa are demarcated in bold and subfamilies demarcated in colored boxes.

RAxML and MrBayes topologies is *Mollemeta edwardsi* Simon, 1894. The monophyly of the subfamily Tetragnathinae is well supported in all analyses, with *Cyrtognatha* Keyserling, 1881, sister to other sampled genera. *Hispanognatha* Bryant, 1945, is nested within *Tetragnatha* Latreille, 1804, in all analyses, and *Antillognatha* Bryant, 1945, is also nested in *Tetragnatha* in analyses using RAxML and MrBayes (figs. 61, 63). *Glenognatha* Simon, 1887, is sister to *Pachygnatha* Sundevall, 1823, in all analyses. Metainae monophyly is well supported in all analyses, with support for all genera with multiple representatives, and the only topological difference is the placement of *Zhinu* Kallal and Hormiga, 2018, as sister to *Dolichognatha* (maximum likelihood, figs. 61–62) or *Metellina* (Bayesian inference, fig. 63); it was weakly supported in both cases. Leucauginae is present in all analyses but weakly supported in the tree resulting from RAxML (fig. 61). *Opadometa* Archer, 1951, nests within *Leucauge* White, 1841, a result strongly supported in all analyses. *Harlanethis* is weakly placed in the clade including *Tylorida*, *Orsinome* Thorell, 1890, and *Mesida* clade in the maximum likelihood analyses, but in Bayesian analyses, it is weakly supported near rogue lineages *Chrysometa* and *Allende*. *Taraire* and *Tawhai* are always sister taxa, weakly supported as a sister group to *Chrysometa* + *Allende* in maximum likelihood analyses but sister to Nanometinae in results from MrBayes. *Taraire* and *Tawhai* diverged from each other 49 (27–74) Ma. *Iamarra* was also a rogue taxon, with a different, weakly supported position in each analysis.

In all analyses, Nanometinae is monophyletic, with *Pinkfloydia* sister to the *Nanometa* clade, with widespread high support within. *Nanometa tasmaniensis* is sister to all other *Nanometa*. The so-called small *Nanometa* species—represented in the molecular analyses by *N. dutrorum*, *N. forsteri*, and *N. gentilis*—form a clade in all analyses. In all cases, the relationships recovered are *N. dutrorum*, sister lineage to *N. gentilis*, and *N. forsteri*. According to our Bayesian analysis, Nanometinae is approximately 72 (49–99) Ma, and the two constituent genera diverged approximately 59 (38–82) Ma.

DISCUSSION

This work is the latest of several to include a number of nanometine taxa, but it is the first to describe the species used in molecular phylogenies, such as those by Dimitrov and Hormiga (2011), Dimitrov et al. (2017), and Kallal and Hormiga (2018), all of which included at least six nanometine tetragnathids and whose results for the subfamily have been largely congruent across analytical treatments. In all analyses, *Pinkfloydia* and *Nanometa* are sister genera and reciprocally monophyletic. In all analyses, *Taraire*, and *Tawhai* are strongly supported as sister lineages to each other but are not placed with confidence by either maximum likelihood or Bayesian inference In the RAxML analysis, they are placed sister to the clade including *Allende* and *Chrysometa*, two lineages that have traditionally been rogue taxa in similar analyses (figs. 61–63). Analyses using IQ-TREE also placed *Iamarra multitheca* nearby, and Bayesian analyses placed *Taraire* and *Tawhai* sister to Nanometinae. *Taraire rufolineata* was also recently placed with high support sister to Nanometinae (Dimitrov et al., 2017). However, given the incongruence between analyses as far as these two clades are concerned, we are reluctant to classify *Taraire* and *Tawhai* as nanometines. *Harlanethis* is, based on its morphology and molecular placement, a leucaugine, and *Iamarra* was unstably placed in the phylogenies.

The dating analyses results presented here are consistent with those of Dimitrov et al. (2017) and Kallal and Hormiga (2018), who used Sanger multilocus data, and Fernández et al. (2018), who used transcriptomic data. All analyses suggest multiple colonizations of New Zealand by nanometines. Most of these occur around 22 Ma, which are consistent with colonization after the so-called New Zealand Oligocene drowning, although *N. lagenifera* probably arrived earlier

and as such could represent another arachnid that defies the drowning paradigm (see others in Boyer and Giribet, 2009; Giribet and Boyer, 2010). There also appears to be a degree of Tasmanian endemicity despite the relative recency of its separation from mainland Australia about 14,000 years ago (Lambeck and Chappell, 2001).

Nanometine anatomical features make it particularly difficult to diagnose and optimize synapomorphies at this node. As currently circumscribed, this lineage represents two genera that have different morphology but are strongly monophyletic. Depending on the analysis, *Taraire*, *Tawhai*, *Metleucauge* Levi, 1980, *Chrysometa*, and *Allende* are related to Nanometinae, all of which have no subfamily designation. The positions of these genera in particular are sensitive to taxon sampling and tree inference method. The internal female genitalia of *Nanometa* is characterized by four chambers and are remarkably similar to those in *Taraire*, but differ greatly from *Allende*, *Chrysometa*, and *Tawhai*, which have well-sclerotized spermathecal walls (fig. 52H). The external genitalic features are either apomorphic and homoplastic, as in the case of the large pores on the epigynal plate in *Pinkfloydia* and *Tawhai*, or symplesiomorphic for *Nanometa* by having a flat, sclerotized epigynum with variation only in the place and orientation of the genital openings. *Pinkfoydia* is also notable because it shares similar internal epigyna with *Metleucauge*. Depending on the analysis, *Metleucuage* is sister to leucaugines or nanometines, or it falls among the rogue lineages including *Azilia*, *Chrysometa*, and *Allende*, but always with low support. Both genera have flexible spermathecae and fertilization ducts relatively short and relatively straight. However, spermatheca wall sclerotization is particularly homoplastic in tetragnathids and this character evolution must be optimized analytically.

Pedipalpal cymbia all share basal and median processes. However, this character is considered symplesiomorphic as it is present in *Mollemeta* Álvarez-Padilla, 2007, *Meta*, *Metellina*, *Allende*, *Taraire*, *Chrysometa*, and others. A possible synapomorphy for Nanometinae as currently circumscribed could be the CEBP shaped as a relatively large spine and attached to the cymbium, as in *Pinkfloydia* and *Nanometa* (e.g., figs. 8, 17, 25; Hormiga, 2017: figs. 2, 3). This spine is smaller in *Taraire* and *Chrysometa*, long and flattened in *Tawhai*, and in *Allende* bearing small teeth in some species. The embolic division features are also fairly similar in *Nanometa*, with a conductor shaped as a curved, flattened translucent disk, with an enlarged and folded margin that covers the embolus distally. *Pinkfloydia*, in another example of a morphologic feature shared with a nonnanometine, has a conductor that more closely resembles *Allende* (and some Metainae) in that it is not flattened, more sclerotized, and projects apically as it curves with the embolus. The conductor of *Taraire* is also translucent, but it either curls, as in *Pinkfloydia*, or folds enclosing the embolus at both sides, as in *T. oculta*. The *Tawhai* conductor is reduced to a small membrane. *Nanometa* species lack an embolic apophysis, while *Pinkfloydia*, *Allende*, *Tawhai*, *Taraire* and *Chrysometa* conspicuously have them. *Metleucauge*, in this regard, is anomalous in having a conductor divided into two sclerites and no embolic apophyses.

The study of the genitalia of these species also allows us to clarify one of the morphological terms that have been previously discussed in regard to tetragnathids: the apophysis of the embolus. In prior works, the members of the clade Metainae were united by the presence of a process emerging from the base of their embolus, and as such called the metaine embolic apophysis (MEA; e.g., Álvarez-Padilla and Hormiga, 2011; Hormiga et al., 1995). However, this embolic process is also present in non-metaines, including *Allende*, *Chrysometa*, *Cyrtognatha*, and *Pinkfloydia* (Álvarez-Padilla, 2007; Álvarez-Padilla and Hormiga, 2011; Levi, 1986; Dimitrov and Hormiga, 2009, 2011). As part of this study, we found a comparable structure in the three newly described genera as well. Because of its appearance in taxa outside Metainae, we prefer the term basal embolic apophysis (BEA) for this structure.

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On the cover: Nanometa tasmaniensis, male from Lake St. Clair National Park, Tasmania, Australia, suspended on a traveling thread; photo by G. Hormiga.